



# **State of Florida**

## **Division of Forestry**

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# **Fire Risk Assessment System**

## **(FRAS)**

### **User Guide**

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## I. Installation

The Fire Risk Assessment System, referred to as FRAS, contains three separate installation steps.

1. Installing the ArcView FRAS application,
2. Installing the FlamMap program, and
3. Ensuring your District and Weather Influence Zone (WIZ) data is copied to disk.

The installation programs have been provided to ensure maximum flexibility for future upgrades of FRAS and the FlamMap program. In addition, the FRAS installation procedures are provided independent of the FRAS project Published Results data since these have been provided separately.

Follow the instructions provided in this section to properly install FRAS. Ensure all other Windows applications are closed that may be active before installing.

Note that users, who have ArcView Spatial Analyst and would like to recreate the WFSI layer, will need to install the FlamMap application. This is recommended. The installation for FlamMap is included on the distribution CD. Users who would like to create reports for an Area of Interest will also need Crystal Reports installed. Crystal Reports is an optional install option included with ArcView.

### **Installation Steps**

The first step is to install the ArcView FRAS application.

#### ***Installing FRAS***

The installation for FRAS is accessed through the **setup.exe** file located in the **FRAS** directory provided on the distribution CD.

This program installs the following components for the application:

**1. The Tutorial data set is installed to a location defined by the user.**

The user can define where they would like the Tutorial data set to reside. The Tutorial data set is a sample set of layers for a small area within the Bunnell District that is provided as a default District data set with the application to support testing and training. The Tutorial data set can be installed with the Published Results data or in a separate location.<sup>1</sup> We recommend that the Tutorial data be installed in the same location as the Published Results data.

FRAS provides the flexibility of allowing users to locate [District](#) data (including the Tutorial data set) on any path location they choose. This is an important capability when considering the large size of the District datasets. For those users with data for multiple Districts they may choose to store the data on different disk drives.

All District and [WIZ](#) data must adhere to a standard subdirectory structure that utilizes a “**FRAS\Districts\...**” and “**FRAS\WIZs\...**” organization. All District-wide data must be located *off of* these two subdirectories using the standard District and WIZ naming convention. The [FRAS Directory Organization](#) section describes this in detail.

A function is provided in FRAS that allows the user to easily change the data path location (see [Set Data Directory](#)). This allows the user to store data for different Districts on different locations, typically due to the large file size and potential disk storage limitations, yet utilize them in the application by simply changing the data directory setting at any time. This is also true for the Tutorial data set.

**2. The FRAS ArcView extension (FireRiskAssessment.avx) is installed to the “Ext32” subdirectory of your ArcView install directory.**

---

<sup>1</sup> The District Published Results data is provided separately from the FRAS application as a deliverable of the Fire Risk Assessment project.

While a default project file is provided and is recommended for use for training and testing, FRAS has been developed as an ArcView extension that will operate in any ArcView project file. Refer to the [FRAS Application Design](#) section for detailed information about this distinction.

3. **Application files are installed to an "FRA" subdirectory of your ArcView install directory.**

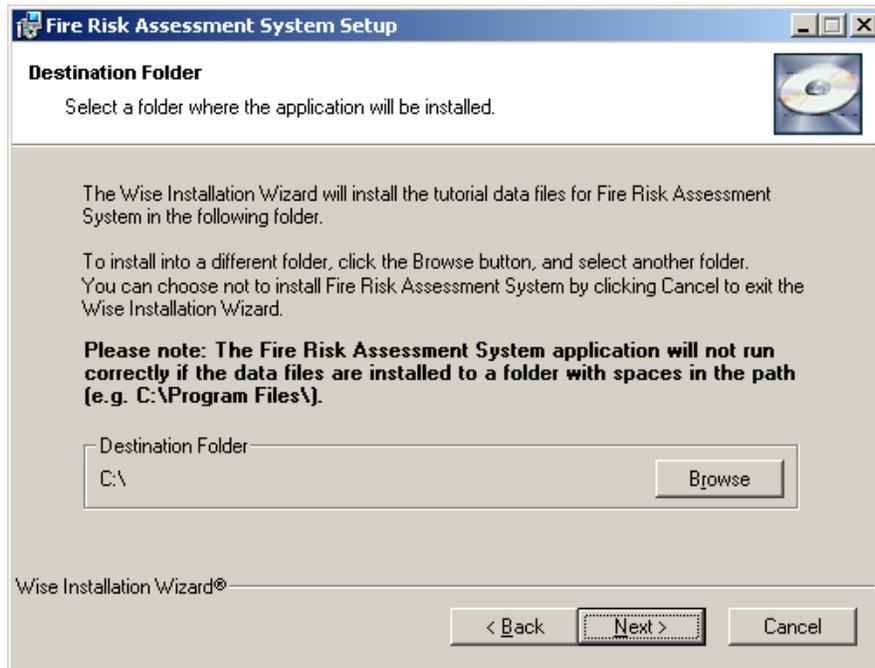
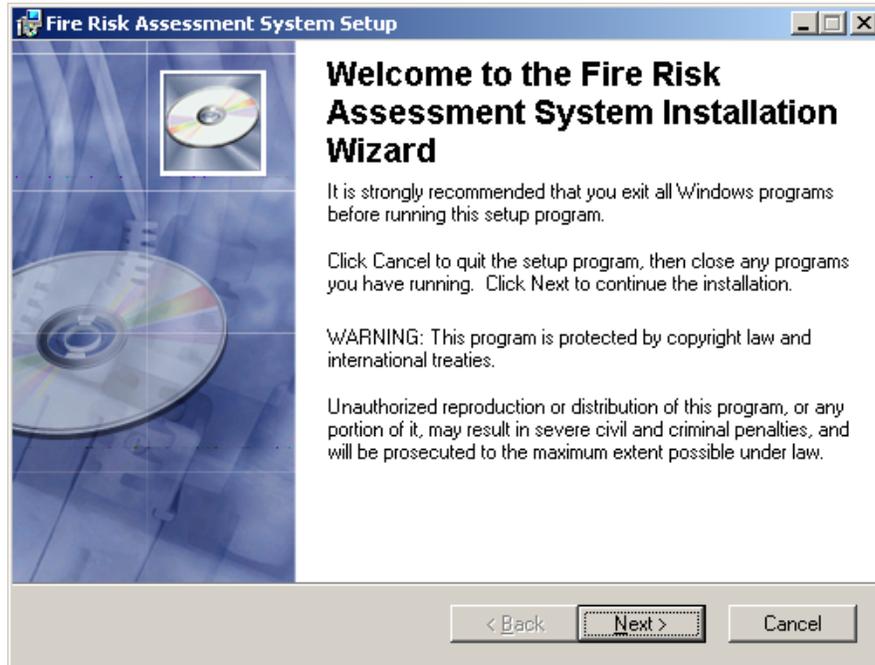
The core application configuration files are maintained in a subdirectory of the ArcView software. This is typically "c:\ESRI\AV\_GIS30\ArcView" but may differ on a specific machine. The installation program automatically determines where ArcView has been installed and installs the "FRA" subdirectory.

4. **A sample ArcView project that uses the extension is installed to the same location as your tutorial data.**

The sample project file (**FRAS.apr**) is the default for running FRAS. We recommend that this project file be used until the user has experience with the application. The project file has been designed to lessen the learning curve and aid users during initial usage and training. The default project file is automatically installed in the "FRAS" subdirectory.

To install FRAS, double-click the **setup.exe** file and follow the instructions in the setup program to choose the tutorial data destination. This dialog is shown in [Figure 1](#).

Figure 1: Installing FRAS



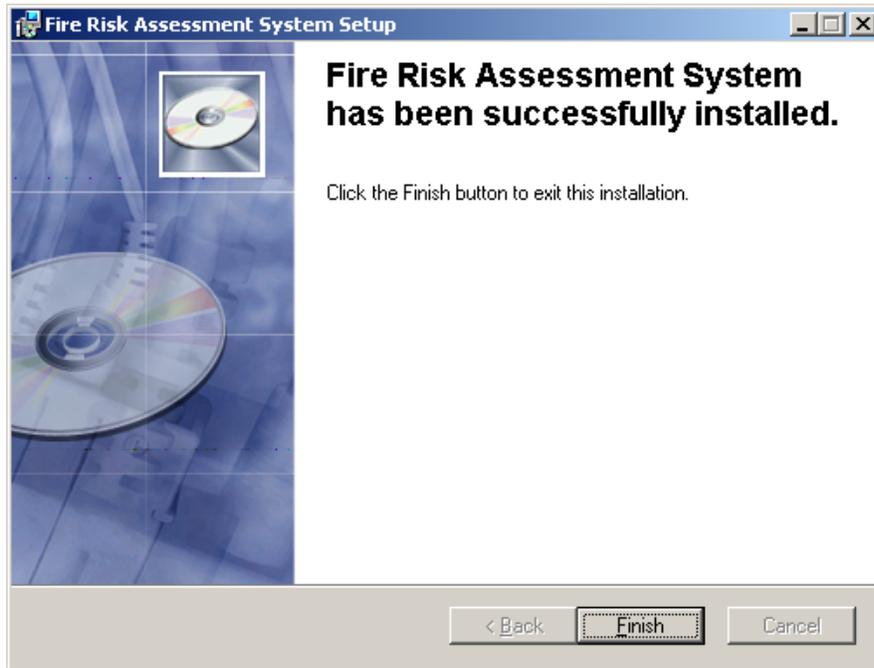
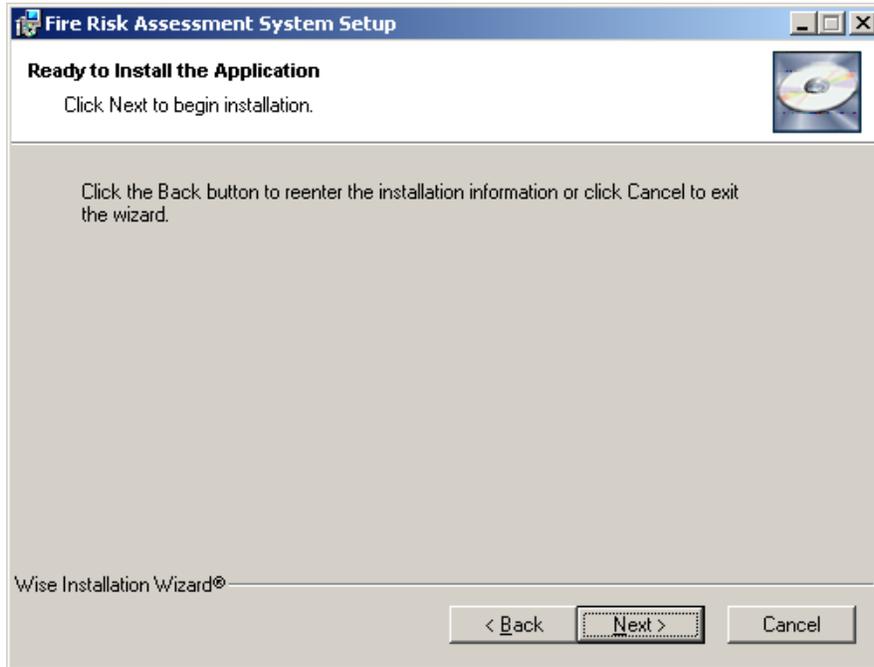
By default the "C:" path location is defined. Remember that when installing the Tutorial data, a "FRAS\Districts\Tutorial" and a "FRAS\WIZs\Tutorial" subdirectory will be added to whatever source path selected. We recommend that you browse to where you have located your Published Results District data source path. This will allow you to utilize the District data or the Tutorial data without changing the data directory within the application. If you install the Tutorial data in a different location, you will need to change the data directory whenever you need to use either data set.

**Note that the Destination Directory you select cannot include spaces in the subdirectory names.** This is a limitation within ArcView. If spaces are included in the subdirectory names an error message will appear.



After using the Browse button to select the Tutorial data destination, press the **Next>** button. You will then have an opportunity to reenter the installation information or cancel the install (see [Figure 2](#)). After pressing the **Next>** button again the setup will then install the application. When the installation is complete you will be presented with the completion dialog (see [Figure 2](#)). Simply press **Finish** to complete the installation.

Figure 2: FRAS Ready to Install and Installation Complete Dialog



### ***Installing FlamMap***

If you will be utilizing the FRAS modeling capabilities to recreate the Wildland Fire Susceptibility Index (WFSI) data, you also need to install the FlamMap program after FRAS installation is complete. The FlamMap installation program is provided on the distribution CD but operates as a separate installation task. Note that due to some recent bug fixes by Dr. Mark Finney with the FlamMap program, two separate steps are involved for installing FlamMap.<sup>2</sup> These include:

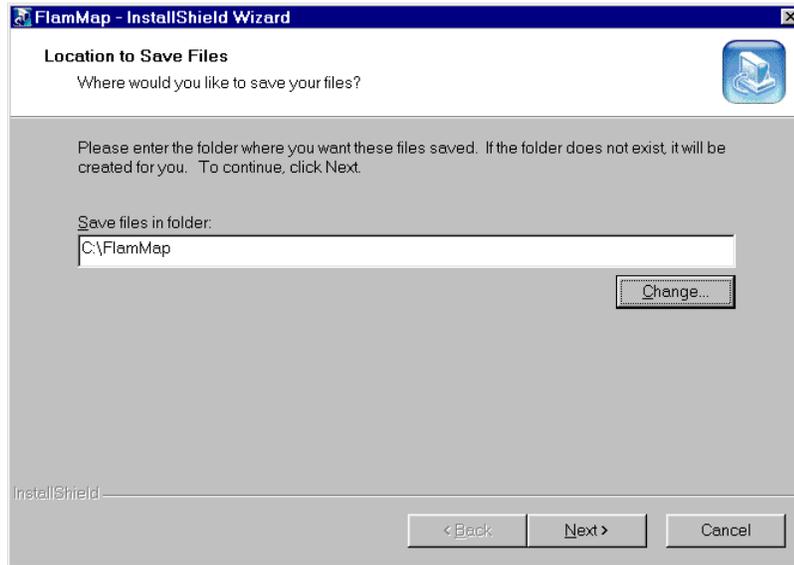
1. Installing the latest FlamMap release (v1.05), and
2. Updating the FlamMap executable program file (.exe).

#### *Installing the Latest Release*

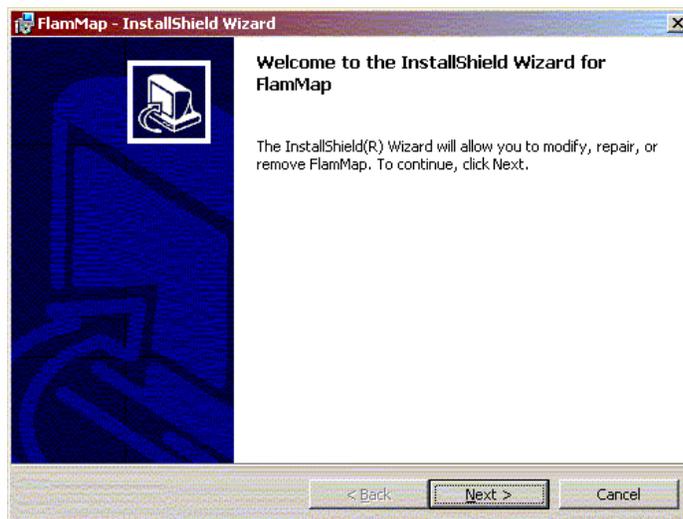
To install the latest distribution of FlamMap double click on the **FlamMap\_1.05.exe** program found on the **FlamMap** folder on the CD. This will initiate a series of dialogs that will prompt you through the installation.

---

<sup>2</sup> Dr. Finney is the author of FlamMap and provided support to fix bugs that arose with the use of the FlamMap program.

**Figure 3: Installing FlamMap – Step 1**

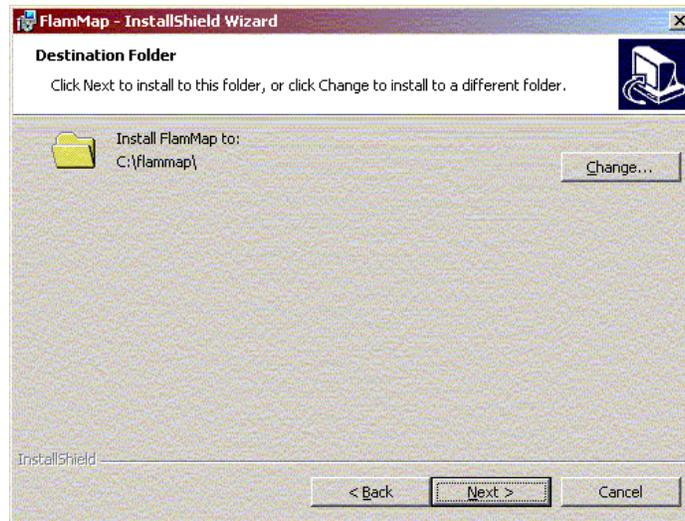
We recommend that the default path locations be used during the installation.

**Figure 4: Installing FlamMap – Step 2**

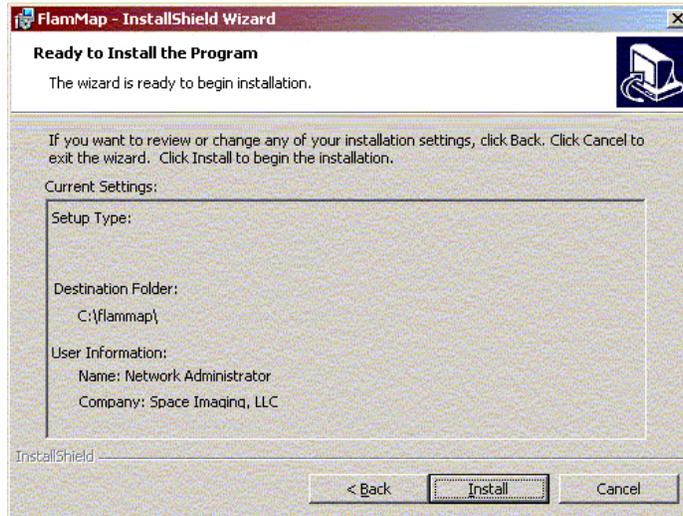
Once the initial path is defined you will be prompted with the FlamMap install splash screen. Press **Next>** to proceed.

We recommend you use the default path location for the FlamMap program. However, if you prefer you can define another path or drive. FRAS will automatically look for the FlamMap program location when it starts. If it does not find the program you will be prompted to locate it. A separate function is also provided (see [Set FlamMap Directory](#)) from the main FRAS Setup menu to allow you to explicitly define the location at any time. This will facilitate the use of another version if perhaps a new version of FlamMap is installed in the future.

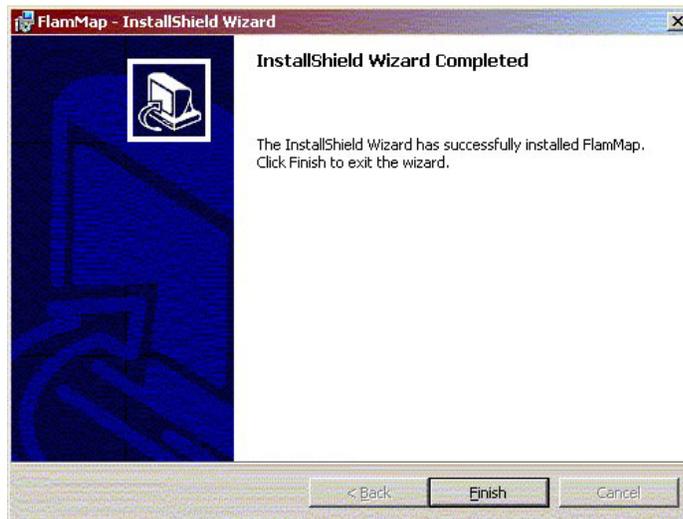
**Figure 5: Installing FlamMap – Step 3**



Once you define the path location you will be prompted to begin the actual installation process. Press the **Install** button.

**Figure 6: Installing FlamMap – Step 4**

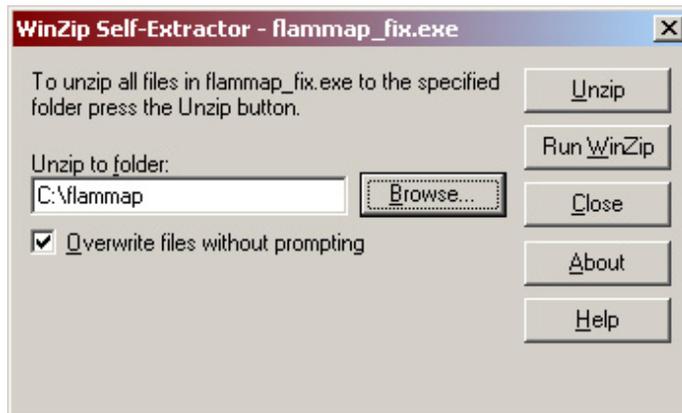
Once the installation is complete you will be prompted with a completion dialog. Press **Finish** to complete the installation process.

**Figure 7: Installing FlamMap – Step 5**

### *Installing the FlamMap Application Update*

During testing of the WFSI modeling components of FRAS, a new version of the executable was released. It is necessary to install this upgrade in order for FRAS to run properly. The upgrade must be installed separately and simply involves extracting the new FlamMap executable program from the self-extracting zip file (**FlamMap\_fix.exe**) into the FlamMap program location. This file can be found in the **FlamMap** folder on the CD. This will replace the FlamMap.exe program. Simply double click on the **FlamMap\_fix.exe** program. Figure 8 presents the dialog for this step.

**Figure 8: Installing FlamMap Fix Dialog**



To complete this step press the **Browse...** button and select the folder where you installed FlamMap. By default this is "**C:\FlamMap**". Press **Unzip** to overwrite the original program exe file with the new program exe file. Press **Close** to exit the dialog.

To confirm you have successfully installed the bug fix version of FlamMap, start the FlamMap program by selecting **Start-Programs-FlamMap**. Once the FlamMap window appears select **Help-About**. The following version information should appear in the **About FlamMap** dialog. You can exit FlamMap.



Your installation of FlamMap is now complete.

If you do not have the correct version information (v1.07) as shown above, you have probably installed the new program into the wrong location. Repeat the installation of the fix and ensure you place the new .exe file into the original installation folder for FlamMap.

## Un-Installing the Application

As with any Windows installation, you may uninstall either the FRAS or FlamMap application through the **Add/Remove Programs** dialog in the Windows Control Panel.

Select "**Fire Risk Assessment System**" or "**FlamMap**" from the list of currently installed programs and click "Remove".

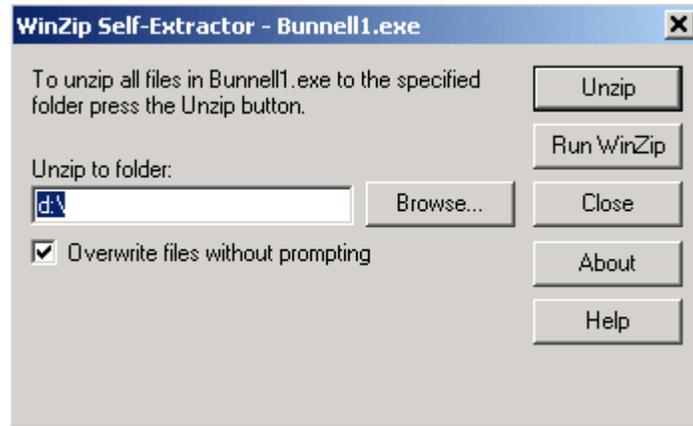
The complete removal of the FRAS application requires manual deletion of the \$AVHOME\FRA (i.e. c:\ESRI\Av\_Gis30\ArcView\FRA) directory to remove previously generated AOIs. Only remove the FRAS data directory (i.e. d:\FRAS) if the data needs to be updated or is no longer needed.

## Installing the District Data

The District Data has been provided to DoF on CDs. The table below summarizes the number of Data CD's for each district.

District #	District Name	# of CDs
01	Blackwater	2
02	Chipola River	3
04	Tallahassee	2
05	Perry	2
06	Suwannee	2
07	Jacksonville	2
08	Waccasassa	3
10	Bunnell	2
11	Withlacoochee	2
12	Orlando	2
14	Lakeland	2
15	Myakka River	2
16	Okeechobee	2
17	Caloosahatchee	2
18	Everglades	2

The executables on the FRAS Data CDs are labeled by District; and CD number if more than one CD exists. For example, Bunnell has two CDs; the executable on the first CD is called 'Bunnell1.exe' and the second CD contains 'Bunnell2.exe'. To begin the install double-click the 'District#.exe' file. You will be presented with the dialog shown below:



When installing the District data, a district directory and the associated WIZ directories will be added to the source path you select. For example, for Bunnell the following subdirectories will be created:

- **'FRAS\Districts\Bunnell'**,
- **'FRAS\WIZs\WIZ08'**,
- **'FRAS\WIZs\WIZ10'**, and
- **'FRAS\WIZs\WIZ11'**.

If the data spans more than one CD, insert the second CD and double-click on the executable. The data should be unzipped to the same folder as CD1. For example, if the Bunnell1 files were unzipped to the "d:\\" folder then the bunnell2 data should be unzipped to the "d:\\" folder as well. Follow same instructions for the third CD (Chipola River is the only district with three data CDs).

For easier use within FRAS, we recommend that data for multiple districts be installed in the same FRAS parent directory. This will allow you to utilize the other District data or the Tutorial data without changing the data directory within the application. If you install the data in a different location, you will need to change the data directory whenever you need to use each data set.

**The names of the data directories and subdirectories must remain unchanged in order for FRAS to run properly.**

## II. Overview of the Fire Risk Assessment Project

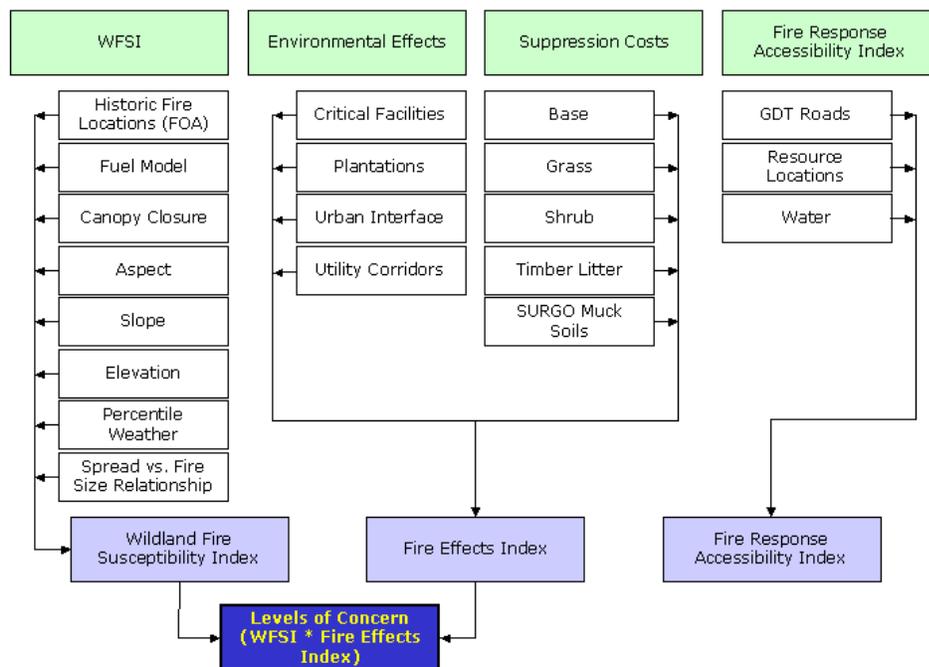
### Fire Risk Assessment Model Components

This section provides a brief overview of the key FRA model components. These are the:

- Wildland Fire Susceptibility Index
- Fire Effects Index
- Levels of Concern
- Fire Response Accessibility Index

Figure 9 below displays the inputs to these key components.

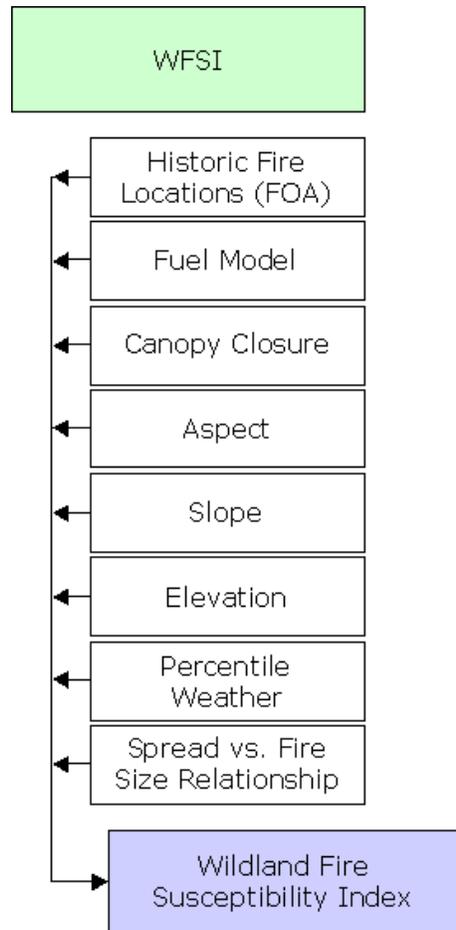
Figure 9: Key Component Inputs



### **Generating the Wildland Fire Susceptibility Index**

The Wildland Fire Susceptibility Index (WFSI) is a value between 0 and 1. It was developed based on the mathematical calculation process for determining the probability of an acre burning. The WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of Wildland Fire Susceptibility. Due to some necessary assumptions, mainly fuel homogeneity, it is not the true probability. But since all areas of the State have this value determined consistently, it allows for comparison and ordination of areas of the state as to the likelihood of an acre burning.

The first input to the calculation is determining the probability of an area igniting (Historical Fire Ignitions). Knowledge of the fuels in the area (fuel model), the topographic attributes of the area (aspect, slope and elevation), the canopy closure for shading from the sun and sheltering from the wind and the potential weather (fuel moistures and wind speed) allow for the calculation of expected fire spread rate. Given a wildland fire ignition with a defined spread rate, an expected final fire size can be estimated from historic fire information (Spread vs. Fire Size Relationships).



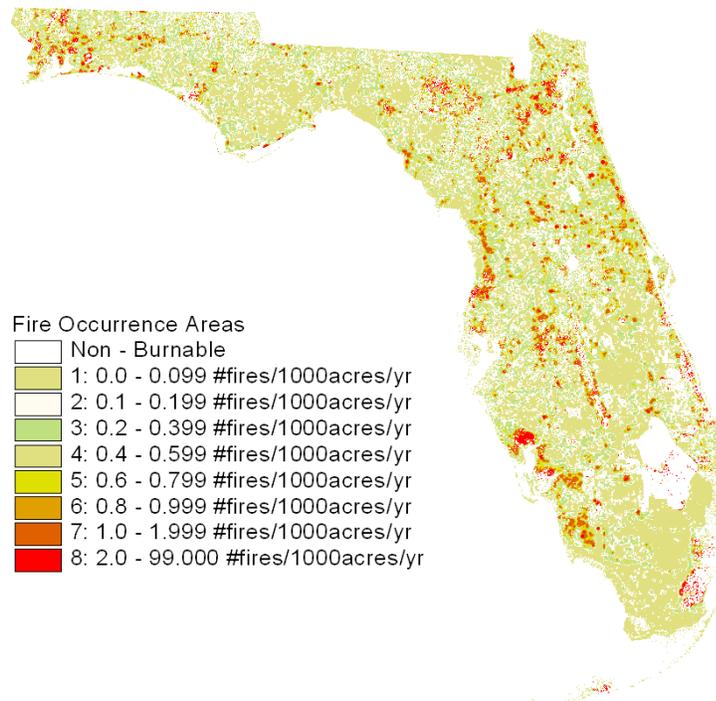
#### *Wildland Fire Occurrence*

The potential for wildland fire occurrence is based on historic fire ignition data from the Division of Forestry, the USDA Forest Service, the USDI-Department of the Interior (DOI) and the Department of Defense (DOD).

Fire occurrence data for the DOI agencies included the National Park Service, the Fish and Wildlife Service and the Bureau of Indian Affairs. Fire occurrence data for the DOD agencies included US Air Force's Eglin Air Force Base. Fire occurrence data was gathered for 20 years. The years 1981-2000 are used for the base period. For some agencies, fire occurrence data was not available for this entire time period and for these agencies, fire occurrence was annualized based on the number of years available.

A grid illustrating the probability of a wildland fire igniting was developed using ARC/INFO GRID by analyzing the location of historic ignitions ([Figure 10](#)). Fire occurrence rates in Fire Occurrence Areas (FOA) are described as the number of fires ignited per 1,000 acres per year. A surface grid with fires per 1,000 acres per year was generated using the Density function in ArcInfo GRID. FOAs were developed to identify areas where the probability of a fire igniting is similar. Hence, within an FOA, the probability of each acre igniting is the same.

**Figure 10: Florida Fire Occurrence Area Map**



### *Fire Behavior and FlamMap*

Potential fire behavior was evaluated using the program FlamMap. FlamMap is a spatial modeling based analytical tool. It uses topographic information, fuel characteristics, and weather to calculate fire behavior values such as rate-of-spread, flame length, fire type, and other characteristics of fire behavior.

The purpose of using FlamMap is to generate fire behavior data that are comparable across the landscape for a given set of weather, fuels and fuel moisture data inputs. FlamMap is based on the GIS data themes and algorithms used in FARSITE (Fire Area Simulator) as described by Finney (1998).

GIS data is required for 5 data themes and optional for 3 themes. These are:

#### Required (Mandatory) Themes

- Elevation
- Slope
- Aspect
- Surface fuel model
- Canopy cover

#### Optional Themes

- Stand Height
- Canopy Base Height
- Canopy Bulk Density

For the FRA project, only the required (mandatory) themes were used.

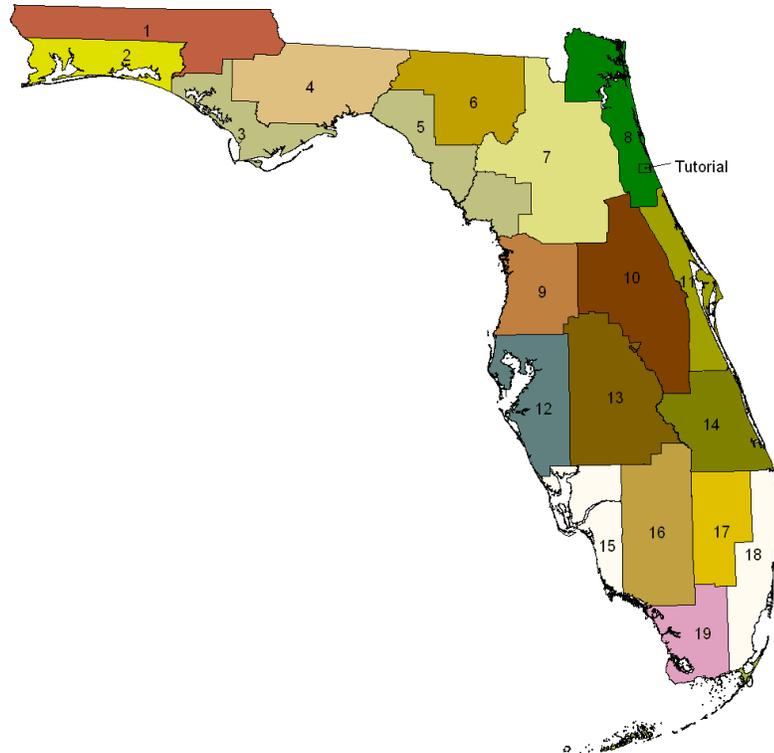
The fire behavior variable calculated by FlamMap for the FRA is fire rate of spread (ROS). This variable was developed because it can be used to estimate a fire's expected fire size using Spread versus fire Size Relationships. Additional fire behavior outputs such as fire intensities and

flame length are available outputs of the FlamMap program. FlamMap calculates the behavior of a fire occurring in each 30x30 meter cell under defined percentile weather conditions. Fire behavior is described independently for each individual cell. FlamMap does not account for contagious processes that may affect fire behavior in an adjacent cell.

These defined weather conditions were determined for four percentile weather categories.

*Percentile Weather and Weather Influence Zones (WIZ)*

Weather in the state of Florida varies geographically so Weather Influence Zones (WIZ) were developed by Dr. Scott Goodrick, the Division of Forestry State Meteorologist ([Figure 11](#)).

**Figure 11: Florida Weather Influence Zones**

Twenty Weather Influence Zones (WIZs) were identified for the state. Within each WIZ, daily weather data was gathered from 1981 - 2000 from land management agency maintained weather stations and from National Oceanographic and Atmospheric Administration (NOAA) maintained weather stations.

A computer program was developed by the Division of Forestry's State Meteorologist to geo-reference the weather observations from the weather stations within a WIZ to the geographic center of the WIZ. Hence, one weather data set was developed with one 2 p.m. weather observation for each day from January 1, 1981 through December 31, 2000 for each WIZ. From this weather data set, percentile weather was developed for each WIZ.

For each WIZ, one weather data set was developed with the 2 p.m. weather observation for each day from January 1, 1981 through December 31, 2000. This data was checked for errors and then imported into the USDA-Forest Service's FireFamilyPlus program. The National Fire Danger Rating System (NFDRS) index Spread Component (SC) was calculated for each day. The SC is an estimate of the spread rate of a fire burning with the assumptions of weather, fuels and topography.

The fire season was assumed to be from October 1 through May 31. The SC was calculated using a NFDRS fuel model G. Though little fuel model G exists within Florida, fuel model G contains fuel loading in all of the dead (1-h, 10-h and 100-h) and live (herbaceous and woody) fuel categories. This allows for the influence in the SC calculation of the fuel moisture values in all of the fuel categories. In addition, climate class 3 (sub-humid / humid) and slope class 1 (0-25%) were used.

The Spread Component was then divided into four commutative percentile categories:

- Low (0-15%),
- Moderate (16-90%),
- High (91-97%) and
- Extreme (98-100%).

The median SC was determined for each category. The environmental values for 1-h, 10-h, 100-h timelag fuel moisture, live herbaceous fuel moisture, live woody fuel moisture and the 20 foot 10 minute average wind speed were determined as the average of the respective values on days when the SC was equal to the median SC (see [Definition of Terms](#) for more information). This allowed for the determination of four percentile weather categories with the percent of occurrence of each category and with environmental values to define the weather conditions within each category.

*Proportion (Percent) of Fires That Occur Within Each Percentile Weather Category*

For each day from January 1, 1981 through December 31, 2000, the NFDRS Spread Component was calculated using the *FireFamilyPlus*

program. Each fire within the fire occurrence database for all agencies within a Weather Influence Zone has a fire start date. Each historic fire was assigned a Spread Component. The four percentile weather categories were also developed using the same assumptions for SC and the four categories have SC ranges. Hence, a correlation could be made assigning each historic fire to one of the four percentile weather categories. From these assignments, the proportion of fires that occurred in each percentile weather category was determined.

#### *Spread versus Resultant Fire Size Relationships*

A relationship between the rate of spread and final fire size was developed using the fire report data from the Division of Forestry for the period 1981-2000 for each Weather Influence Zone. Several fire size classes were used to estimate the amount of time from fire start to fire containment. For all Weather Influence Zones, the time from fire start to fire containment for the benchmark fire sizes of 0.5, 2, 10, 50, 100, 500 and 1000 acres was determined. Additional fire sizes greater than 1000 acres were used when fires of these sizes occurred historically within a WIZ.

The average fire rate of spread for each benchmark fire size was estimated by using the double ellipse area model developed by Fons (1946) as documented by Anderson (1983). The model calculates fire size (Area) as:  $\text{Area} = K * D^2$  where K is a constant dependent solely on mid-flame wind speed and D is the distance the fire has traveled from its point of origin ( $D = \text{rate of spread} \times \text{containment time}$ ). Mid-flame wind speed was set at 1, 2, 3, 5, 7, 9, and 12 mph for each of the benchmark sizes of 0.5, 2, 10, 50, 100, 500 and 1000-acre fires. The mid-flame wind speed was set at a value of 12 mph or larger for fires with final fire sizes greater than 1000 acres.

A relationship between the fire size and average rate of spread values for the benchmark fire sizes was developed using multi-variable regression. For all fuel models except fuel model 3, a fourth order polynomial was determined to be the best equation form to use. The form is  $Y = A + B*X + C*X^2 + D*X^3 + E*X^4$  where X = rate of spread, Y is the expected fire size and A-E are the regression coefficients. In some cases, A was changed so that a 0.5 acre fire was expected when the rate of spread was 1 chain per hour (1.1 feet per minute). For fuel model 3, a power

function was used. The form is  $Y = A + B \cdot X^C + D \cdot X^E$  where X is the rate of spread.

#### *Maximum Fire Size*

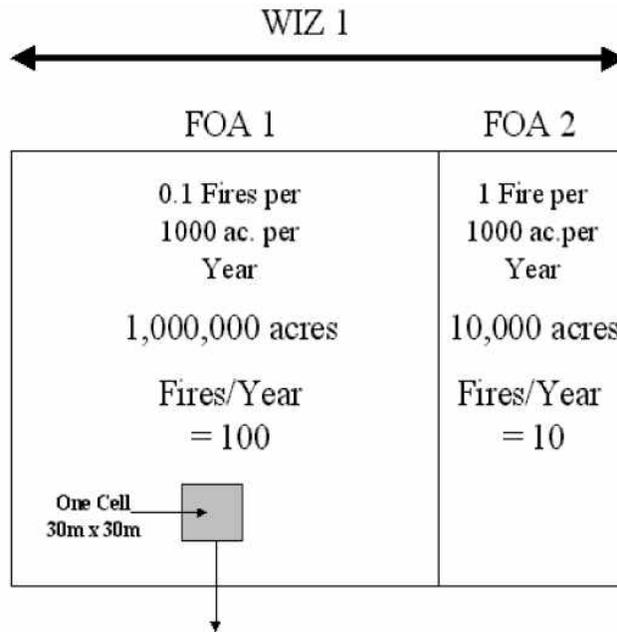
A maximum expected fire size was set for all Weather Influence Zones to account for physical conditions that would limit fire spread.

#### *Calculation of the WFSI*

The WFSI is calculated for each percentile weather category for each 30 meter x 30-meter cell on burnable area within the State. The calculation is done for cells within a FOA /WIZ intersection.

To assist in the understanding of the calculation, an example is presented. Assume that the calculation is being done for a cell in FOA 1, WIZ 1. The data flow is shown via the example in Figure 11 below. For the example, assume that the fire occurrence rate in FOA 1 is 0.1 fires / 1000 acres / year and assume there are 1,000,000 acres in the FOA 1, WIZ 1 intersection.

Figure 12: WFSI data flow example



Row	Item	Percentile Weather				Total
		Low	Moderate	High	Extreme	
1	Percent of Fires	10%	80%	8%	2%	100%
2	Number of fires	10	80	8	2	100
3	Rate of Spread (ch/hr)	2	5	12	24	N/A
4	Final Fire Size (Acres)	1	6	98	900	N/A
5	Annual Acres Burned	10	480	784	1800	3074
6	WFSI	0.0001	0.0048	0.0074	0.0180	0.0374

Figure 12 shows that within FOA 1 and WIZ 1, there are 100 fires per year.

Row 1 gives the Percent of Fires that have historically occurred within each of the Percentile Weather Categories.

Multiplying the Proportion of Fires in each Percentile Weather Category by the total number of fires in the FOA 1 / WIZ 1 intersection (100 fires) allows for determination of the Number of Fires in each Percentile Weather Category, Row 2.

The FlamMap program has calculated a Rate of Spread for each Percentile Weather Category (Row 3) and a Rate of Spread versus expected Final Fire Size Relationship (Row 4) has been determined. This allows for the determination of the expected Final Fire Size within each Percentile Weather Category.

Multiplying the Number of Fires per year in each Percentile Weather Category by the expected Final Fire Size yields the Annual Expected Acres Burned for each Percentile Weather Category (Row 5).

Dividing the Annual Expected Acres Burned for each Percentile Weather Category by the total acres within the FOA1, WIZ 1 intersection (1,000,000 acres) yields the WFSI within each Percentile Weather Category Row 6). The WFSI for the cell is the sum of the four Percentile Weather Category WFSI values.

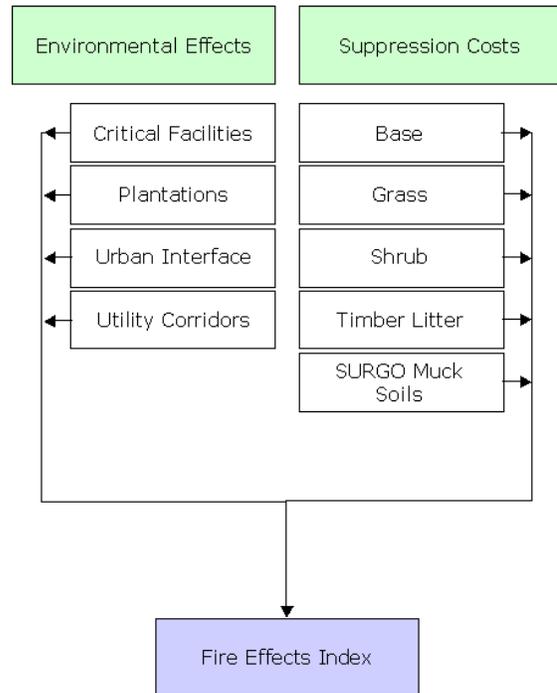
The WFSI calculation is based on the logical calculation process for determining the probability of an acre burning; i.e. acres burned per year divided by the total area. For low Rates of Spread, the WFSI calculated for the cell is most likely quite close to the probability of the acre burning. For higher Rates of Spread, the WFSI overestimates the probability of an acre burning due to the assumptions that the entire FOA/WIZ intersection uniformly has all of the cells fuels and topographic attributes. The goal of the FRA is not to estimate via the WFSI the actual probability of an acre burning but the WFSI can be used to ordinate the burnable areas in the State into categories representing the likelihood of the cell being impacted by a wildland fire.

### Generating the Fire Effects Index

The Fire Effects Index is comprised of two inputs:

1. Environmental Effects
2. Suppression Costs

The purpose of the index is to identify those areas that have environmental values at risk to wildland fire and/or are costly to suppress. The Environmental Effects that are included in this analysis are critical facilities (from DoF burn authorization plan and include schools, hospitals, airports, interstates and highways, etc.), plantations (natural and planted), urban interface, and utility corridors (transmission lines). Each environmental input was assigned an effects score by DoF fire managers using the matrix. See example below:



**Adjust Score for Urban Interface**

		Fire Size (Acres)			
		0 - 9	10 - 99	100 - 999	1000 +
Flame Length (Feet)	0 - 4	1	2	3	3
	5 - 8	2	3	4	4
	8 +	3	4	4	4
Total Score:		37			

< Apply Score >    Cancel    Help

To arrive at a final Environmental Effects score (rating), the individual scores for the inputs were summed: critical facilities, urban interface, plantations and utility corridors.

The suppression costs are evaluated by fuel type. Each cell in the state has been assigned either a base, grass, shrub, timber litter or muck suppression score. DOF fire managers used the matrix shown above to assign the fire suppression and muck scores. The grass, shrub and timber litter scores were based on suppression billing information provided by the DOF districts for the past five years. The final suppression value for each cell was assigned based on the fuel type (or muck soil) on the ground.

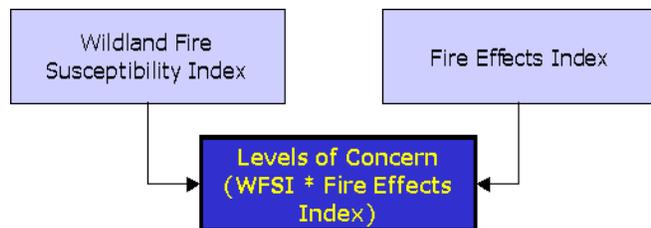
The Fire Effects Index was then calculated by combining the final Environmental Effects and suppression costs scores using the following equation:

$$\text{Fire Effects} = (0.80 * \text{Environmental Effects}) + (0.20 * \text{Suppression Costs})$$

The final Fire Effects Values can range from 0 – 100.

### ***Generating Levels of Concern***

The Levels of Concern (LOC) value was determined by multiplying the Wildland Fire Susceptibility Index by the Fire Effects Index.



$$\text{Level of Concern} = \text{WFSI} * \text{Fire Effects Index}$$

The output values were assigned to nine LOC classes ranging from low concern to high concern. The LOC output can be used to prioritize areas for further analysis. The FRAS allows the capability to modify the fuels, fire occurrence data (modifying WFSI) and Fire Effects Scores to generate new results and compare them to the published data (see next section).

The LOC results can be used to complete a more detailed analysis at the local level and communicate wildland fire management concerns.

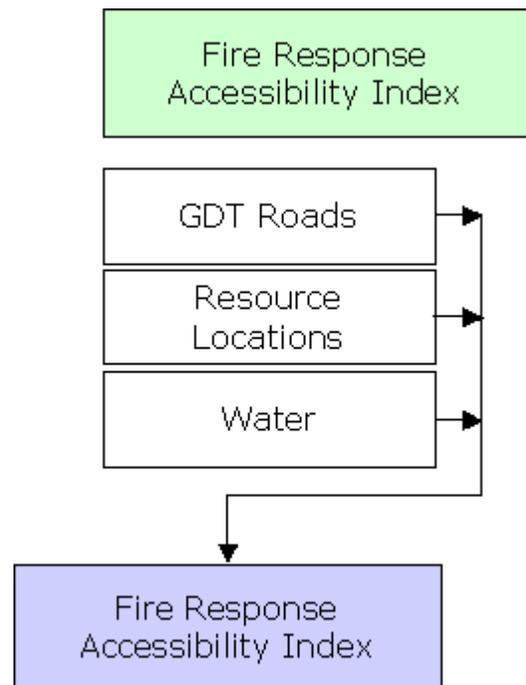
The LOC results can be used to:

- Identify areas where mitigation options may be of value;
- Allow agencies to work together and better define priorities;
- Develop a refined analysis of a complex landscape and fire situations using GIS; and
- Increase communication with local residents to address community priorities and needs.

### ***Generating the Fire Response Accessibility Index***

The Fire Response Accessibility Index (FRAI) is calculated based on distance from resource locations. The speed traveled on roads was estimated at 40 miles per hour. Travel on roads was assumed to be eight times faster than travel off road. Water was coded as 'NO DATA', meaning that travel across water could not be done unless there was a road crossing. A cost distance analysis was run allowing ArcInfo to assign an approximate time to reach each cell.

The Fire Response Accessibility Index allows users to identify areas of low accessibility from their resources. Coupled with the Levels of Concern data, this information will highlight areas where accessibility is low and the level of concern is high, providing valuable information for anyone concerned with the impacts of wildland fire.



## **The Next Step – Using FRAS to Analyze the Effectiveness of Mitigation Measures**

The project Published Results are based on over two years of intense mapping and analysis by a team of technical and fire experts. The FRAS application allows the user to generate new outputs by modifying fuels, modifying fire occurrence modifying the scores of the fire effects. This allows the user to derive a new Wildland Fire Susceptibility Index (WFSI) that can then be used to generate new Levels of Concern (LOC).

The application also allows the user to customize the analysis for a small area of interest (AOI) rather than an entire district and provides tools for printing maps and generating reports which can then be used to compare results.

The FRAS application has been developed as a tool to aid in the assessment of mitigation options within specific Project Areas (reflected by the user AOIs). The application provides mapping and reporting for the Published Results, as well as modeling tools that allow the user to apply their local knowledge and expertise in developing revised output for WFSI, LOC, and accessibility.

By providing access to the suite of results data, and by providing options analysis tools to support analysis of mitigation options for local Project Areas, it is anticipated that the FRAS project results will benefit operational staff in determining potential impacts of management actions for analyzing alternatives to mitigate effects of a fire

## **Future Activities**

The FRA project and FRAS are only a data and methodology foundation for continued proactive fire management and planning. Subsequent activities are required to ensure that the results of the project are widely distributed and used to support management and mitigation mandates. This section reviews the primary activities.

### ***Communicating Published Results of the Assessment***

It is critical that the results of the assessment are communicated so that the Published Results are understood within the State of Florida. With this

information, options can be proposed to mitigate fire risk to an acceptable level.

The FRAS has been designed to support the development of maps and reports that can be used to communicate information to others. Additional hardcopy, large size maps are also being produced to support the dissemination of this information.

It is anticipated that future activities will involve the development of brochures for the public that describe the results of the assessment and provide guidance and more sources of information for addressing fire risk. This information will be consistent with National Fire Plan and State Fire Plan directives.

Future activities may also involve the development of a web site available to the public that will provide more information on the results of the project.

### ***Training and Education***

Proper use of the FRAS will require training DOF District staff and other fire specialists. This training should include guidance on how to best use the application to achieve results, as well as on fire planning education so that the modeling capabilities can be properly applied.

### **III. About the FRAS Application**

#### **Introduction**

##### ***Goals and Purpose***

The primary purpose of FRAS is to provide an automated tool for DoF staff, as well as other Florida fire specialists, to access and use the officially published data results of the Florida Fire Risk Assessment project. A series of spatial map data has been compiled and derived as the key part of the project to support operational staff in the future assessment and management of wildland fire risk across the state. This data has been derived by a team of fire experts and reflects the latest and most accurate data describing the wildland fire risk situation within Florida. Tools are provided in FRAS that support the printing of maps and reports using the Published Results.

It is also anticipated that a key use of FRAS and the results will be to communicate the existing fire risk situation within the state to managers, officials and legislators, not only operational staff. The data has been developed to facilitate comparison of areas across the state in this regard.

In addition, FRAS provides modeling capabilities that facilitate DoF staff in modifying key inputs, such as fuel models and fire occurrence, to analyze the effect of mitigation options on the Wildland Fire Susceptibility Index (WFSI) and Levels of Concern (LOC). Areas where the FOA, WFSI or LOC are high are candidates for mitigation options. This allows District staff to leverage local knowledge and expertise while taking advantage of the data derived from the assessment process.

This User Guide describes in detail the design and operation for FRAS including capabilities to:

1. Review and print maps and reports of the official FRA project Published Results data.
2. Allow the user to define a custom Area of Interest to support modeling of custom outputs, such as ROS, WFSI, LOC, and FRAI as well as reporting and mapping.

3. Change key inputs including resource locations, modifying fire occurrence classes, or modifying fuel models to reflect mitigation options in a defined AOI.

The overall purpose of FRAS is to provide unrestricted access to the data derived from the Fire Risk Assessment project in support of operational staff analyzing mitigation options.

## Application Design

FRAS was developed as a standalone application that operates on the ArcView 3.x GIS software.<sup>3</sup> FRAS was designed to utilize the FlamMap program in a standalone mode to support the calculation of fire behavior outputs including the seamless conversion of data between the two programs. The integration approach also supports future planned development of the FlamMap program that will continue to occur independently by Dr. Mark Finney.

FRAS was also designed to leverage the capabilities found in the ArcView GIS platform. The standard ArcView interface has been used as the framework for the FRAS interface. FRAS is accessed via a series of custom pull-down menu options within ArcView 3.x that provides custom functionality and manages data in the standard ArcView *View-Theme* data organization. All other ArcView functions are available while the FRAS options are available. In several instances, custom tools have been developed to facilitate analysis and review of data. However, none of the core capabilities found within ArcView have been removed. The ArcView GIS platform provides a robust and extensive framework for growth of FRAS and further analysis by operational staff.

The data model employed with FRAS utilizes a predefined directory structure that uses ArcView shapefiles, ArcInfo GRID coverages, and standalone Dbase files (.dbf) as the key data elements. The specific Data Organization is described in [FRAS Data](#).

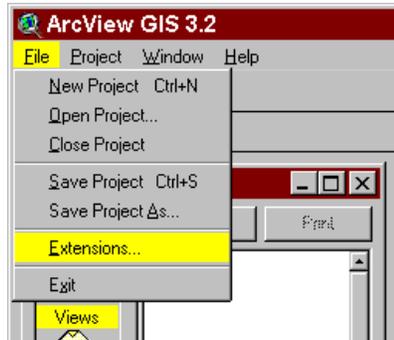
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<sup>3</sup> FRAS was specifically designed to operate on the 3.2 version of ArcView GIS. The application will not operate on the ArcGIS platform.

### ***ArcView Extension versus the ArcView Project File***

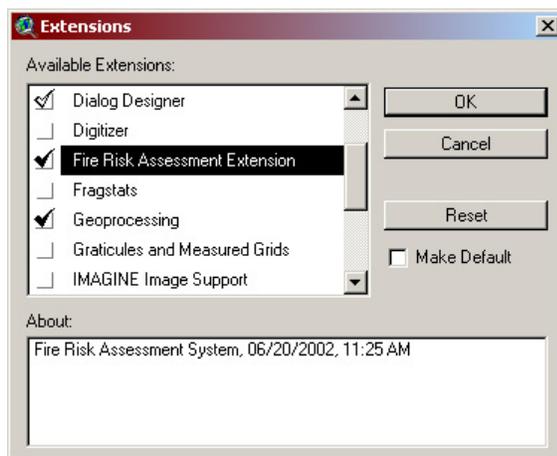
In order to facilitate use of FRAS within the existing use of ArcView projects for District staff, FRAS was designed as an extension. ArcView extensions can operate independently of a specific ArcView project. This allows users to gain access to FRAS capabilities when using their own custom ArcView project files.

To start the FRAS extension, select the **File-Extensions** menu option from the ArcView Project menu.



By clicking on the **Fire Risk Assessment Extension** (see [Figure 13](#)) and pressing **OK** you will add the FRAS menu options to your existing ArcView project. You will now be able to use the FRAS tools.

**Figure 13: The ArcView Extension Dialog**



A default ArcView project is provided as an ideal starting point for learning FRAS. The default ArcView project has predefined themes and has the extension already loaded. The project file is **FRAS.apr** and can be found in the “**FRAS**” installation directory. Double click on the .apr file to open the project.

It is recommended that users utilize this project file until they are familiar with FRAS capabilities. The project file has been designed so it can satisfy all requirements. The use of other ArcView project files is not required, but accommodated.

### **FRAS Process Flow**

The FRAS extension has been designed as a series of pull-down menu options that operate in either the ArcView Project or View interface. The menu options for the Project interface represent a subset of capabilities appropriate for that interface, as does the View interface. In particular, the FRAS Modeling options are limited in the Project interface. [Figure 14](#) presents the ArcView Project menu options.

**Figure 14: The ArcView Project Interface FRAS Menu Options**



The ArcView View interface provides the full suite of FRAS capabilities including:

**FRAS Setup** Options for setting data location preferences.

**FRAS Modeling** AOI selection and modeling capabilities including tools to modify Resource Locations and fuels and to recreate FOA, WFSI, LOC, and FRAI. These represent the primary analytical capabilities within FRAS. Users without Spatial Analyst will have the ability to only Create Levels of Concern.

**FRAS Output** Options to generate maps or standard reports for the Published Results View or the active AOI View.

**FRAS Help** Access to the on-line user guide.

Figure 15 presents the ArcView View interface FRAS menu options. Note the full suite of FRAS Modeling capabilities compared to the Project interface.

**Figure 15: The ArcView View Interface FRAS Menu Options**



## FRAS Data

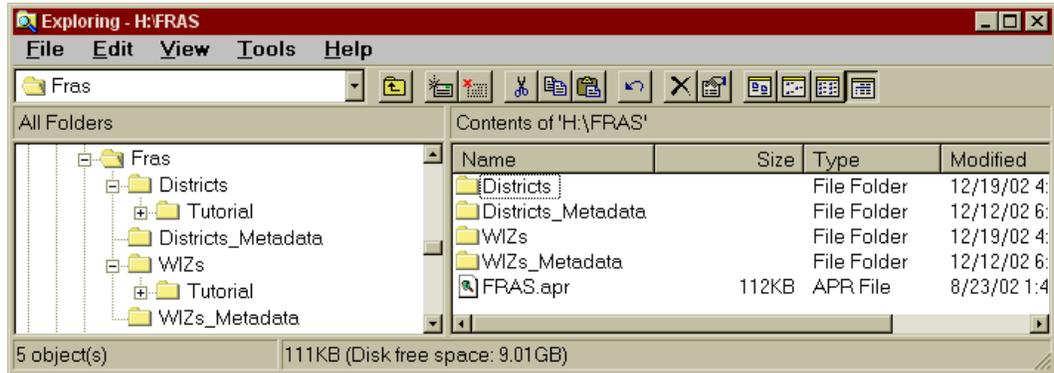
Data used and created by FRAS includes both Published Results from the Fire Risk Assessment project, and custom data for user defined areas of interest.

### **Data Organization**

Data is organized within three primary data folders:

1. Published Results District data,
2. Published Results Weather Influence Zone data, and
3. User defined Area of Interest data.

These data folders are all located within the main FRAS folder. You can locate your FRAS folder on any path, however the **FRAS\Districts**, **FRAS\WIZs** and **FRAS\AOIs** subdirectories will be imposed and used by FRAS. Figure 16 presents an example of this data structure where the main FRAS folder is located directly at C:\.

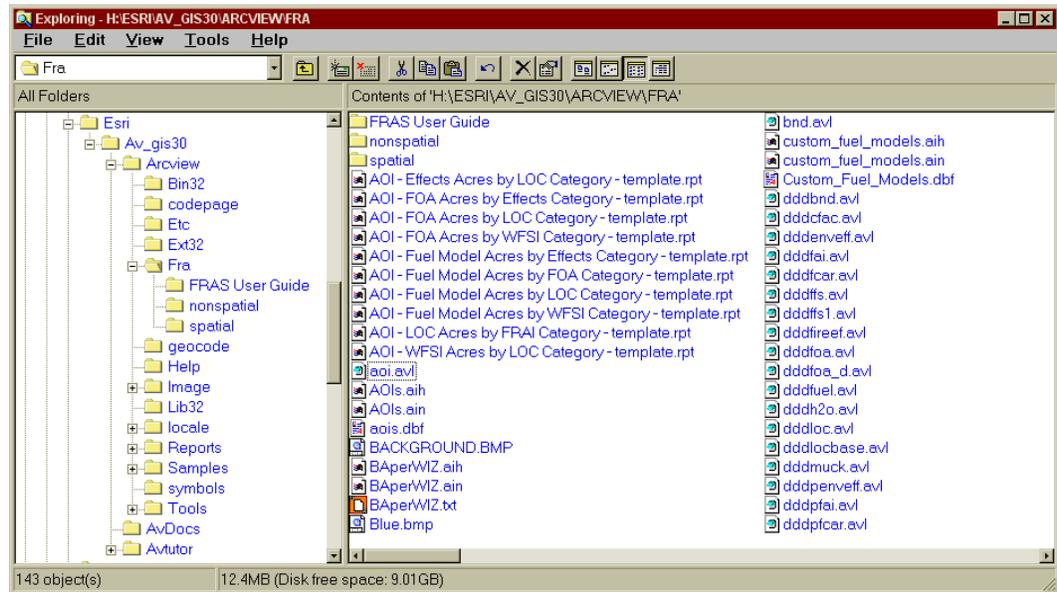
**Figure 16: The FRAS Directory Structure**

Custom AOI data is stored in individual subdirectories created and managed seamlessly by FRAS in the **FRAS\AOIs** folder. AOI subdirectories are created automatically as you add new AOIs with FRAS using a sequential naming convention. This is seamless to the user. For modeling purposes, any modified data, such as fuels, or derived data, such as a new WFSI or LOC, for that AOI is created and stored in the sequential AOI folders. This approach of having separate AOI folders affords an orderly storage of user defined data distinguished from the Published Results.

Tools are provided within FRAS to Add or Remove AOIs under the FRAS Modeling menu options. Refer to the [Defining an AOI](#) section for more detailed information about these capabilities.

FRAS also utilizes numerous data files to support the management and operation of FRAS itself. This data is maintained seamlessly by FRAS in the `\ESRI\AV_GIS30\ArcView\FRA` folder. This folder is created during the FRAS installation process. [Figure 17](#) illustrates this folder. The user should never delete or edit files within this folder.

**Figure 17: The ArcView FRA Directory**



### *Districts and Weather Influence Zones*

The Published Results data is organized and tiled into two separate geo-administrative units, Districts and WIZs. Due to the volume of data for the statewide coverage, base data, mandatory themes and derived data have been tiled by DoF Districts. This approach facilitates better use by the District staff while minimizing the amount of data storage required.

Weather Influence Zones are boundaries defined by the State Meteorologist. Weather information has been compiled and derived by these WIZ boundaries. Refer to the section on [Weather Influence Zones](#) for a more detailed description of the WIZ data content.

### *Ensuring You Have Data for Your District of Interest*

A Tutorial data set is provided with FRAS to support testing and training. However, FRAS was developed to operate on the District and WIZ Published Results data. Accordingly, it is important that you load the data for your relevant Districts and adhere to the data organization prior to using FRAS.

## **FRAS Components**

FRAS is comprised of several core components reflected by the procedural nature of the menu organization. These include:

1. Default ArcView Project and Data Views
2. Published Results Data Access Tools (mapping and reporting)
3. Data Modification tools (Resource locations, Fire Occurrence Classes, and Fuel Models)
4. Modeling tools to recreate WFSI, LOC, and/or FRAI.

These components and their operation are described in detail in [Section IV](#), [V](#) and [VI](#).

## **Technical Requirements**

Successful operation of FRAS requires certain technical prerequisites. These are described below.

### ***User Prerequisites***

Each user of FRAS should have a basic understanding of the operation of the ArcView GIS software. In particular, the user should understand the basic data organization of Views and Themes. An understanding of generic ArcView functions will also provide the ability to use ArcView to enhance the review and analysis of the FRAS data beyond the scope of FRAS.

To aid staff, an introduction to ArcView basics is provided as a separate document. Users are urged to obtain ArcView training in order to maximize the capabilities provided with the FRAS data and application.

### **System Requirements**

Many of the FRAS Modeling capabilities require the use of the ArcView Spatial Analyst module. This program is a separate licensed program. It provides analytical modeling capabilities based on raster algebra techniques. These techniques are mandatory to support the advanced modeling that is involved in calculating WFSI and FRAI. Without Spatial Analyst, modeling capabilities are limited in FRAS and the user will be limited to viewing, mapping and reporting of the Published Results, and calculating LOC based on changes only to Fire Effects scores.

Due to the processing requirements for the modeling functions, the following minimum computer specifications are recommended. Processing times may be slower if a computer with less speed (Mhz or RAM) is used.

- Pentium III (IV preferred)
- 700 Mhz minimum (1 Ghz or higher preferred)
- SVGA monitor resolution (1024x768) or higher
- 128 Mb RAM minimum
- Use of Windows Small Font settings
- Minimum 10 Gb free hard disk space per District

## IV. An Overview of FRAS

This section provides a brief overview of FRAS by providing a description of the capabilities and usage.

### Using ArcView

FRAS has been built using ArcView GIS v3.2. Accordingly, it is important for the user of FRAS to be familiar with the operation of ArcView and particularly how data is organized and accessible within ArcView. An Introduction to ArcView is provided as a separate document. To fully exploit the capabilities of ArcView GIS, it is recommended that users attend an ESRI certified ArcView training course.

### Using the Quick Tour

A separate tutorial document is also available that will provide users a quick tour of the FRAS application. This Quick Tour Guide walks the user through the basic functionality of the application using a small tutorial data set that is provided. Users are urged to utilize the Quick Tour first prior to modeling with their own District data in order to fully understand the capabilities of the application. The tutorial data set has been optimized for quick performance during modeling, and incorporates a range of data values reflecting many different scenarios.

### Organizing Data in Views

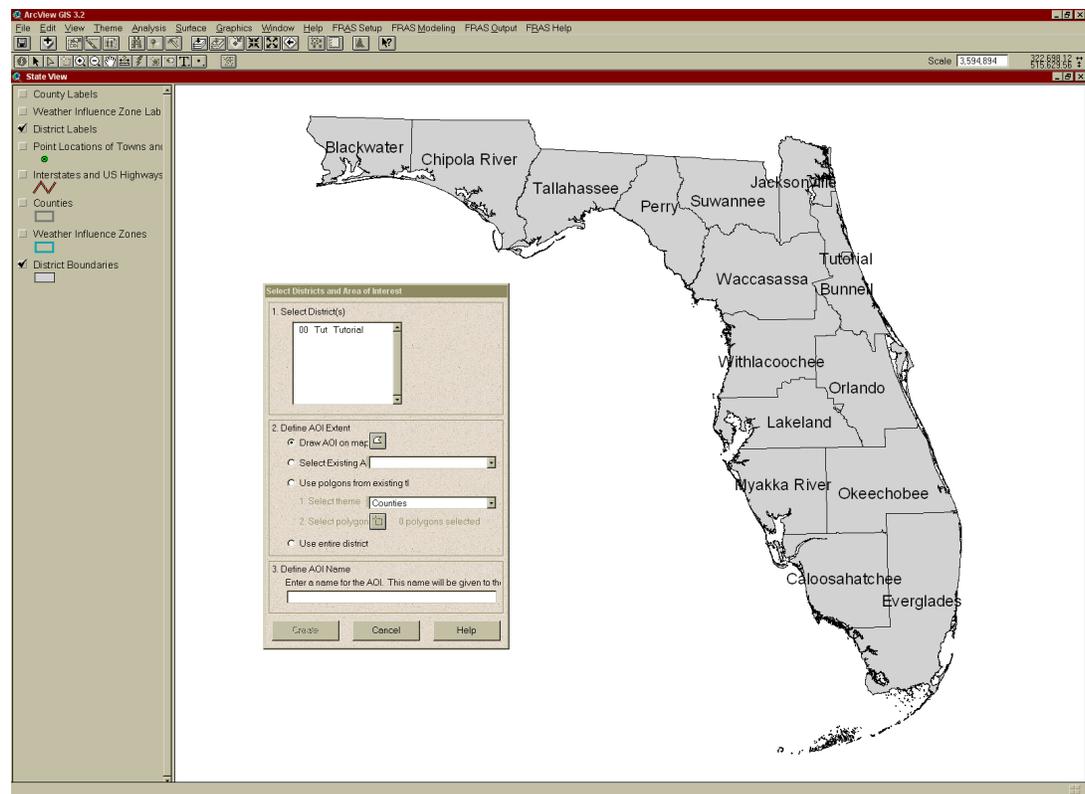
When FRAS is launched, there are three default views that appear. These are:

1. State View
2. DOF Published FRAS Results View
3. AOI Data View

When the program first opens, the **State View** appears along with the District selection tool (see [Figure 18](#)). This view shows the state by

District, County, and Weather Influence Zones. It also provides location landmarks such as point locations of towns and cities, as well as roads to help orient the user. The purpose of this view is to aid the user in selecting a District and an Area of Interest to be viewed or modeled. Once a District is selected, it is highlighted in Yellow on the State View. The user can then depict an Area of Interest using an existing polygon or drawing a new polygon in the view.

**Figure 18: The State View**



Once a District(s) and an Area of Interest are defined, two new views are launched. The first is the **DOF Published FRAS Results View**. This view presents all of the published data themes for the Districts that are selected in the State View. As new Districts are selected, using the **Selecting Districts and AOI** function, the Published Results data is added to the view as new themes. Only Districts that are selected are added as themes to the Published Results view.

The **AOI Data View** is created when the AOI is defined. If an AOI is defined that is smaller than the selected District(s) boundaries, the main data themes are clipped to the AOI boundary and a new AOI Data View is created with the clipped data loaded.

The AOI Data View will be considered the working view. As input and output data is recreated using the Modeling and Output functions, they are loaded into the AOI view. This allows the user to compare results after recreating outputs to the published data.

The AOI Data Views must all be given a unique textual name (description) by the user when selecting the District(s) and defining the AOI. Accordingly, many AOI Data Views can be created, but only a single view can be *active* at any time. Many of the Modeling and Output functions only operate on the active AOI view.

Figure 19 presents the DOF Published FRAS Results view.

**Figure 19: The DoF Published FRAS Results View**

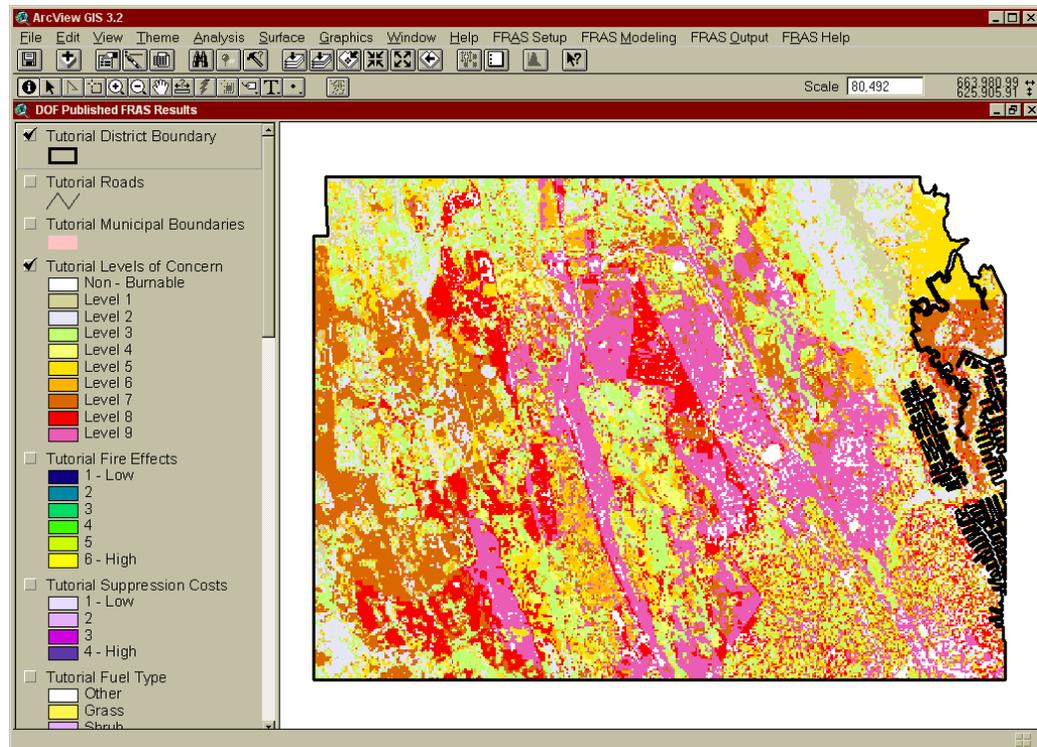
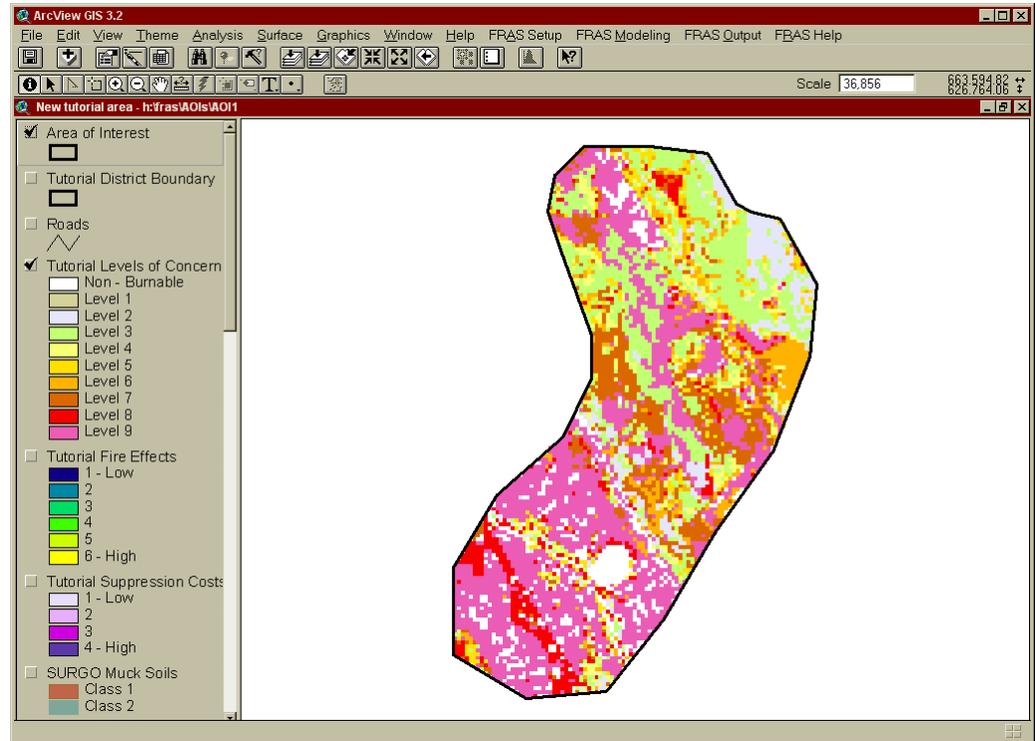


Figure 20 presents an example AOI view created from the Tutorial data set as a District selection.

**Figure 20: An Example AOI Data View**



The name of the view, "**New tutorial area – e:\fras\AOIs\AOI3**" in our example, comes from the user defined name 'New tutorial area' being concatenated with the new AOI folder **e:\fras\AOIs \AOI3** that was seamlessly created to house the specific AOI data. This AOI folder will be used to store all data associated with this view and AOI. The specific path is incorporated into the View name to aid the user in the selection of specific AOI datasets in other FRAS functions.

## Using the Published Results

The primary output from the Fire Risk Assessment is the data developed by the project team of experts that describe fire risk across the state. This is referred to as the Published Results. These outputs provide a data platform for use by operational DoF staff, as well as other fire management personnel, in mitigation planning and communication activities.

The Space Imaging team and the Florida Division of Forestry staff worked for two years to develop the FRA Published Results. These results can be used for identifying areas where more local analysis may be appropriate, target areas for fuels treatments or programs designed to reduce ignitions (posting signs, etc). The results will be extremely useful for local level planning, future development and communicating wildland fire risk to the public.

FRAS has been designed to clearly distinguish the review of the Published Results, and tools to support deriving new results for custom areas of interest. The Published Results data cannot be directly modified with FRAS. However, they can be used as inputs for modeling smaller areas of interest defined by the user. In this regard, FRAS will support District staff in analyzing management options for fire risk mitigation. AOI data is maintained in a separate directory structure that facilitates its reuse without impacting the Published Results data.

Maps and reports can be generated for either the Published Results data or custom AOI data. Separate ArcView *views* are provided for each data set. Each AOI will have its own view. The Published Results view will contain only data for the Districts selected while using FRAS. Multiple Districts can be selected.

## Using the Tutorial Sample Dataset

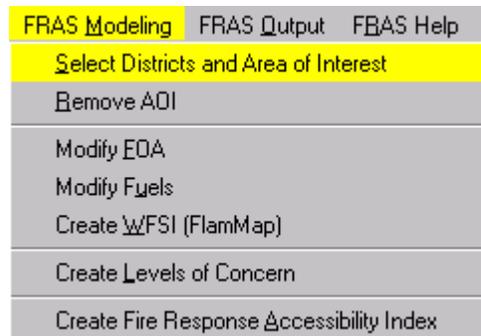
A sample data set is provided with FRAS to facilitate a quick tour of the capabilities of the software. This data represents a small subset of a single District. This sample data will allow you to run through the capabilities of FRAS. You can select the Tutorial data set instead of a District during the **Select Districts and AOI** step. Refer to the Quick Tour Guide for use of the tutorial data set.

## Deriving New Results using the Modeling Capabilities

The key modeling capabilities of FRAS allow the ability to modify input data and derive new output results. Modeling is done based on user defined AOIs through the AOI Data Views. An AOI can be defined as a small subset of a single District, or an area that crosses more than one District. The ultimate goal of modeling mitigation options is to assess the effectiveness of options as measured by changes in output (i.e. WFSI, LOC, etc.). The AOI approach allows the user to define custom areas for modeling without the overhead of an entire Districts data. This greatly enhances the flexibility of the application including performance during modeling.

### Selecting Districts

The first step in deriving new results is to select District(s) that will comprise your AOI. Districts are selected using the **Select Districts and Area of Interest** under the **FRAS Modeling** menu. The tool allows you to select a single District or multiple Districts for analysis.



### Defining an AOI

The **Select Districts and Area of Interest** tool provides three options for selecting an Area of Interest within the District(s) selected. These are:

1. Drawing a single AOI on the map,
2. Selecting an existing AOI that was previously defined, or
3. Using polygons selected from an existing theme.

The alternative to defining an AOI is to use the entire District. For step-by-step instructions on selecting an AOI, see the section on [Selecting A District and AOI](#). To remove an AOI, select the **FRAS Modeling, Remove AOI** menu item.

Once an AOI is defined, and a unique name given for the AOI, a new data view is created for the data, and input data is clipped to the AOI boundary and loaded into the view as themes. This new AOI view is now available for use by the FRAS Modeling functions described below.

### ***Modify Input Data (FOA, FUELS, and FRAI)***

A valuable component of FRAS is the ability to modify key inputs to derive new output data. FRAS provides tools to modify:

- Fire Occurrence Areas,
- Fuel models, and
- Resource locations.

Modifying key input data is often done to reflect mitigation efforts, especially considering fuel treatments. Once these management actions are simulated, the key fire risk assessment model outputs can be recreated and summarized. Refer to [Section V](#) for detailed step-by-step information on how to modify these inputs.

### ***Recreating Output Data (WFSI, LOC, and FRAI)***

Once an AOI view is defined, and any required input data has been modified, the user can recreate the WFSI, LOC, or FRAI output data. The Fire Response Accessibility Index can be recreated using an updated coverage of resource locations. If the user decides to modify either fuels or fire occurrence areas, then the Wildland Fire Susceptibility Index can be recreated using these new inputs. The user has the ability to also recreate the final Levels of Concern outputs using the new WFSI. Step-by-step instructions for recreating output data can be found in [Section VI](#).

## **Compiled Input Data**

A description of the data layers compiled as part of the project follows:

### ***Base Map Layers***

In order to create the FRAS Published Results, Space Imaging worked with DoF to compile several statewide base layers. These base layers are reviewed in [Section II](#).

### ***Surface Fuel Models***

The surface fuel model layer was derived from multi-temporal Landsat Thematic Mapper (TM) imagery using automated classification techniques and extensive field data provided by DoF staff.

### ***Fire Occurrence Areas (FOA)***

The Fire Occurrence Area input is based on historic fire ignition data from the Division of Forestry, the USDA Forest Service, the USDI-Department of the Interior (DOI) and the Department of Defense (DOD). Fire occurrence data for the DOI agencies included the National Park Service, the Fish and Wildlife Service and the Bureau of Indian Affairs. Fire occurrence data for the DOD agencies included US Air Force's Eglin Air Force Base. Fire occurrence data was gathered for 20 years except for Eglin AFB, which was 5 years. The years 1981-2000 are used for the base period. For some agencies, fire occurrence data was not available for this entire time period and for these agencies, fire occurrence was annualized based on the number of years available.

### ***Weather Influence Zones (WIZ)***

Weather Influence Zones (WIZ) were developed by the Division of Forestry State Meteorologist. Twenty Weather Influence Zones were developed for the state. Within each WIZ, daily weather data was gathered from 1981 - 2000 from land management agency maintained weather stations and from National Oceanographic and Atmospheric Administration (NOAA) maintained weather stations. A computer program was developed by the Division of Forestry's State Meteorologist to geo-reference the weather observations from the weather stations within a WIZ to the geographic center of the WIZ. Thus creating a

weather data set with one weather observation for each day from January 1, 1981 through December 31, 2000 for each WIZ.

## **Key Outputs**

### ***Wildland Fire Susceptibility Index (WFSI)***

The Wildland Fire Susceptibility Index integrates the probability of an acre igniting, wildland fire behavior, and historic fire suppression effectiveness. It combines the data from the Fire Occurrence Areas, fire behavior data developed by FlamMap, and expected fire size vs. fire spread rate relationships. The Wildland Fire Susceptibility Index (WFSI) was computed for each 30x30 meter cell of burnable vegetation within the State.

### ***Fire Effects Index (FEI)***

The Fire Effects Index is based on Environmental Effects and Suppression costs. The purpose of the index is to identify those areas that have environmental values at risk to wildland fire and/or are costly to suppress. The Environmental Effects that are included in this analysis are:

- Critical facilities (from DoF burn authorization plan and include schools, hospitals, airports, interstates and highways, etc.),
- Plantations (natural and planted),
- Urban interface, and
- Utility corridors (transmission lines).

To arrive at a final Environmental Effects score, the individual scores for the inputs were summed: critical facilities, urban interface, plantations and utility corridors. The suppression costs are defined using fuel carrier and muck soils. Each cell in the state has been assigned a base, grass, shrub, timber litter or muck suppression score.

The Fire Effects Index was then calculated by combining the final Environmental Effects and suppression costs scores giving Environmental Effects an 80% weighting and Suppression Costs a 20% weighting.

### **Levels of Concern**

The final Levels of Concern value was assigned by multiplying the Wildland Fire Susceptibility Index by the Fire Effects Index. These output values were assigned to nine LOC classes ranging from low concern to high. The LOC output can be used to prioritize areas for further analysis. FRAS also allows the capability to modify the fuel models, fire occurrence data and fire effects scores to generate new results and compare them to the Published Data.

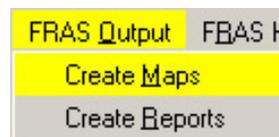
### **Fire Response Accessibility Index (FRAI)**

The Fire Response Accessibility Index (FRAI) for a cell is calculated based on distance from Resource Locations. The speed traveled on roads was assumed to be 40 miles per hour with travel on roads being assumed as eight times faster than travel off road. A cost distance analysis was run using ArcView to assign an approximate time to reach each cell.

## **Generating Output Maps and Reports**

One method for comparing recreated AOI results and Published Results is to compare the results in the AOI view and the Published Results view on screen. FRAS also allows you to print maps and reports for the AOI View and Published Results so the user can compare the tabular results as well as hard copy maps.

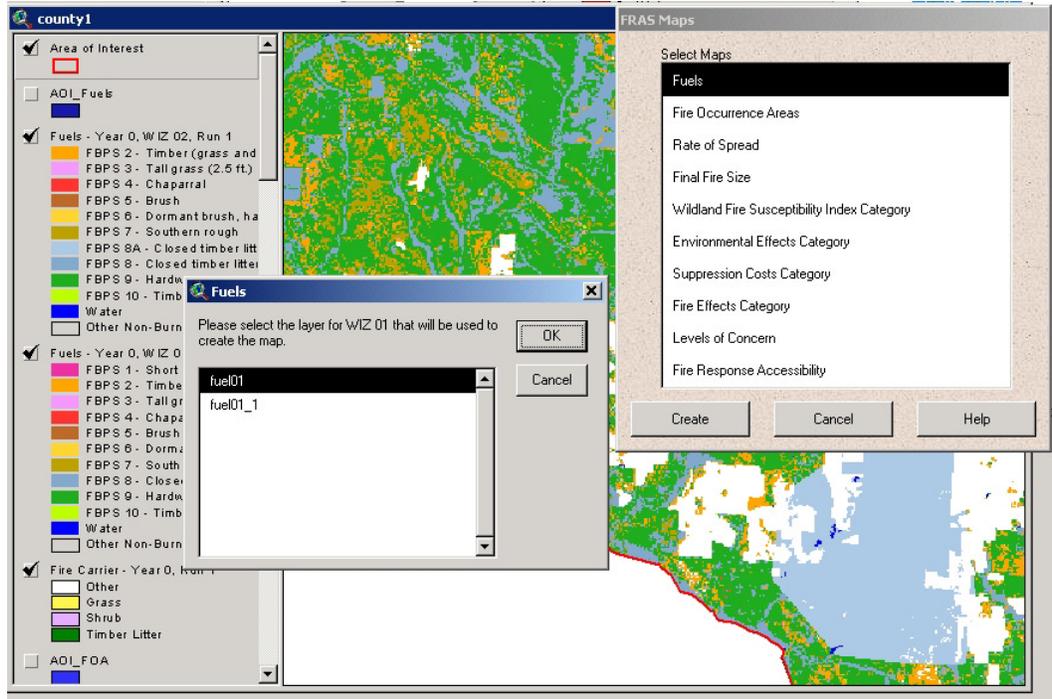
Output maps and reports can be created by the **FRAS Output** menu options.



In order to create a map for the AOI data the AOI View needs to be the active view. Clicking on the AOI View title bar activates the view (i.e. the view is now the active view). Otherwise the map will be created using the published data from all available Districts. If AOI inputs or outputs have been recreated, Fuels for example, the program will ask which Fuels layer is to be used to populate the map. In this regard, the mapping tools track the various output that can be recreated in the AOI view. [Figure 21](#)

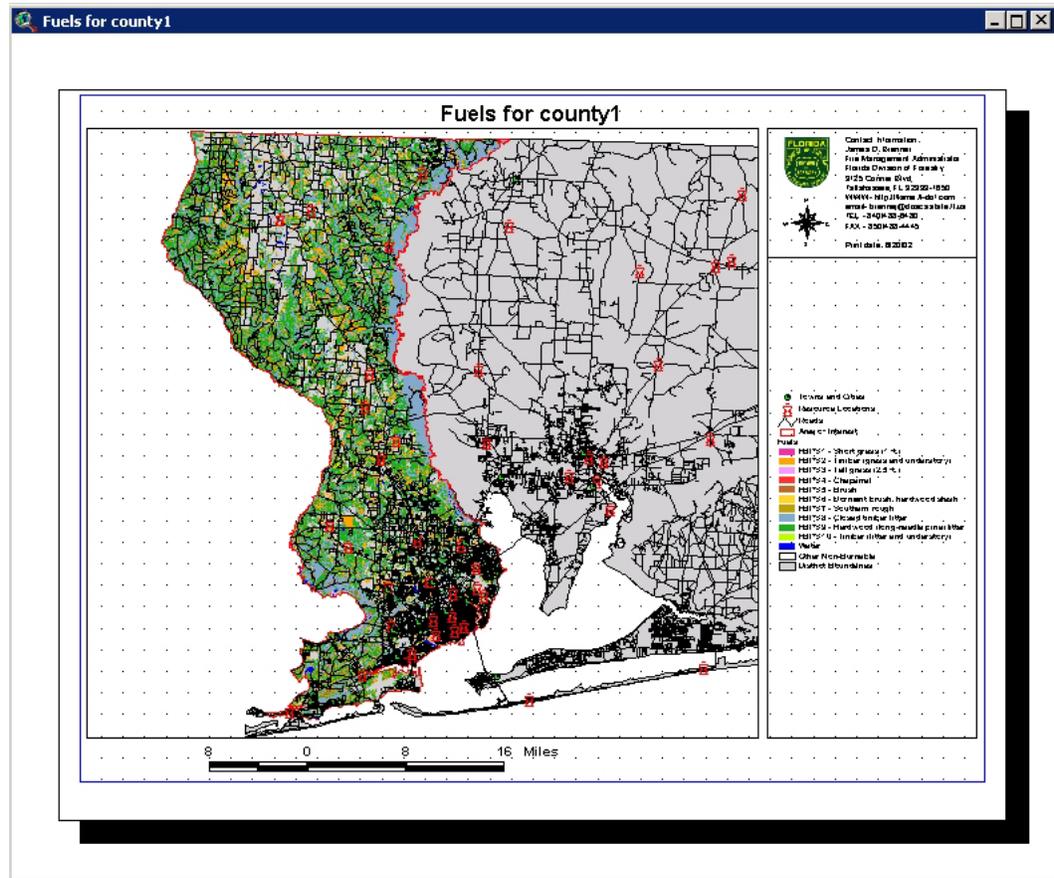
presents an example dialog for creating a map using the FRAS Output options.

Figure 21: Example Map Dialog



Once a map type is selected, the data required is automatically loaded into the AOI view (or Published Results view) and a standard ArcView map layout is created. [Figure 22](#) presents an example output map layout.

**Figure 22: Example Map Layout**



[Section VII](#) describes in detail the steps involved in generating maps and reports for both the Published Results and a custom AOI data view.

## **V. Using FRAS for Fire Management Planning**

The modeling functions provided within FRAS are intended to provide information to be analyzed in developing options to mitigate effects of a wildland fire. Areas where the FOA, WFSI or LOC are high are candidates for mitigation projects. The alternatives are to:

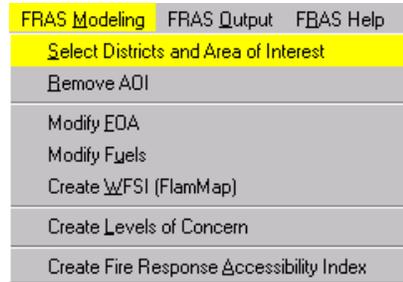
- 1) Change fire occurrence (prevention)
- 2) Change fuel loading (fuel treatment),
- 3) Change fire suppression capability (change resource locations), and/or
- 4) Create defensible space (location specific survivability).

FRAS allows for delineation of project areas (referred to as areas of interest – AOIs) with the ability to recreate outputs such as WFSI and LOC based on changes in FOA rate and/or fuel model. Changes in accessibility can also be modeled. This functionality supports the comparison of different mitigation efforts.

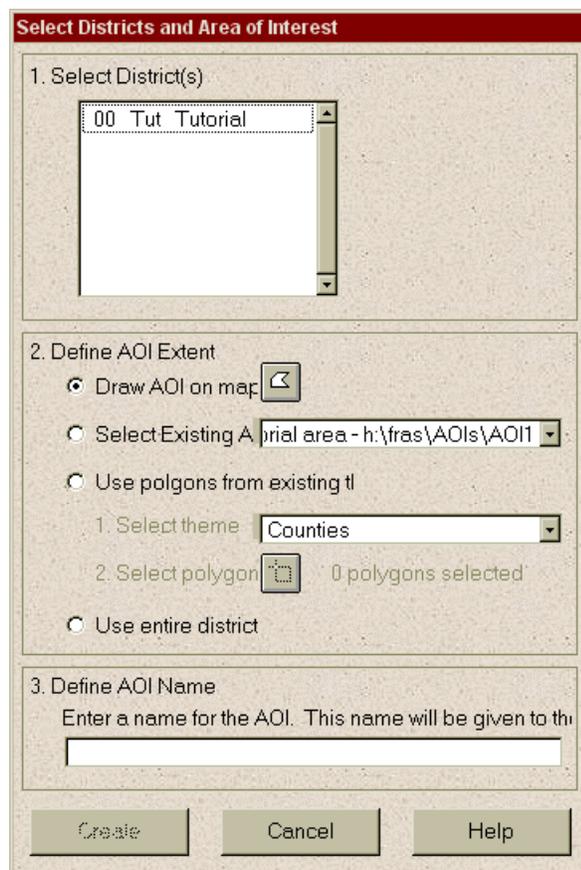
### **Selecting a District and Area of Interest**

The first step is to select a District, or Districts, and to define the Area of Interest within the District selection. This step will result in the loading of data into the Published Results view, and create a new AOI view to support modeling and AOI-based mapping and reporting. The AOI view can contain an entire data set for the selected Districts, however in most cases a smaller Area of Interest will be defined using the tools provided. In this regard the AOI view will typically contain a small subset of data clipped to the user defined AOI boundary. If an entire District is selected as the AOI, the program may take a long time to process the information.

Districts are selected using the **Select Districts and Area of Interest** under the **FRAS Modeling** menu. The tool allows the user to select a single District or multiple Districts for analysis. [Figure 23](#) presents the dialog.



**Figure 23: The Select Districts and AOI Dialog**



The **Select Districts and AOI** dialog contains three sections that need to be completed by the user. These are:

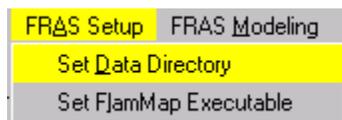
1. Select Districts
2. Define AOI Extent
3. Define AOI Name

A scroll list of Districts is provided based on data found on the hard drive by FRAS. District data is located using the path location defined by the [Set Data Directory](#) tool (see next section). Only those Districts located in the defined path that adhere to the standard data organization will be listed. It is possible to use different data locations for your District and Tutorial data (i.e. put different District data on different disks). By changing the Set Data Directory, a different list of District data will be displayed in the scroll list. It is recommended that the Tutorial data set be installed in the same location as the published District data (see [Install Instructions](#) for a discussion of this).

Step-by-step instructions on using this dialog are presented below.

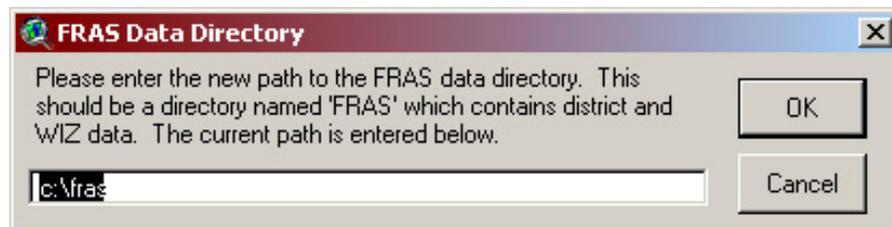
### **Step 1: Defining the Path for District Data**

Prior to using the selection dialog you must define where your District data is located on your computer or network. Select **Set Data Directory** option from the **FRAS Setup** menu.



You will be prompted to type in the FRAS source data folder path. This is shown in [Figure 24](#). This path is stored by FRAS and used to locate all District data for processing. By changing this location at any time, other locations for District data can be identified (i.e. if data for different Districts is stored on different paths or disks). In most cases, the District data and the Tutorial data set can be stored in the same location to eliminate the need to change this location.

**Figure 24: Set Data Directory Dialog**



Press **OK** once you have defined the data path.

### ***Step 2: Selecting Districts***

Click on the **FRAS Modeling** menu and then **Select Districts and Area of Interest**. The selection dialog as shown in [Figure 23](#) will appear.

Select a District from the scroll down list. As you select a District it will be highlighted in yellow on the State View and FRAS will zoom to the selected District(s).

Note that you can select multiple Districts by holding the SHIFT key while selecting Districts. The Tutorial data set cannot be selected with other Districts.

### ***Step 3: Defining an Area of Interest (AOI)***

Three options are provided for selecting an Area of Interest:

1. Drawing a single AOI on the map,
2. Selecting an existing AOI that was previously defined, or
3. Using polygons selected from an existing theme.

An alternative to defining an AOI is to use the entire District. It is anticipated that in most cases, the user will want to define a smaller AOI that reflects their area of responsibility, or potential mitigation project area. [Figure 25](#) presents the options from the dialog.

**Figure 25: Define AOI Extent Options**

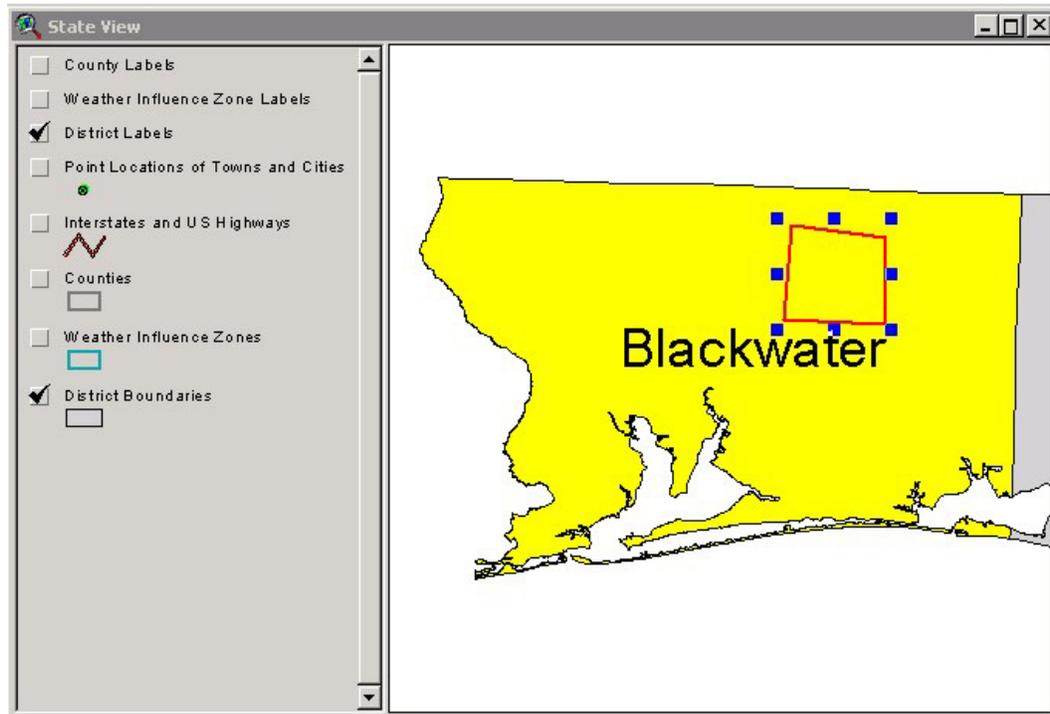
The screenshot shows a dialog box titled "2. Define AOI Extent" with a light beige background. It contains several options and controls:

- Draw AOI on map: This option is selected and includes a square button with a left-pointing arrow.
- Select Existing AOI: This option is unselected and includes a dropdown menu currently displaying "Tutorial Test View - Entire AOI".
- Use polygons from existing theme: This option is unselected and includes two sub-controls:
  - 1. Select theme: A dropdown menu currently displaying "Counties".
  - 2. Select polygons: A square button with a dashed border and a right-pointing arrow, followed by the text "0 polygons selected".
- Use entire district(s): This option is unselected.

### *Digitize AOI Boundary On Map*

The most common method of defining the AOI extent is to digitize the area boundary using your mouse on the State View. Click with the left mouse button to digitize boundary points and double click to end digitizing. If you want to re-digitize close the first polygon and begin digitizing again only the last polygon defined will be used to define the AOI extent. [Figure 26](#) presents an example of an AOI shown on the State View.

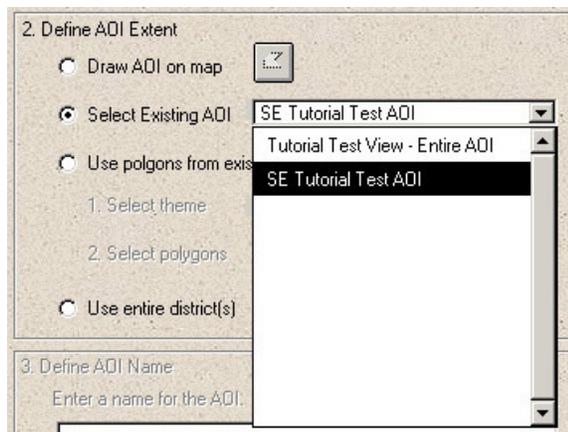
**Figure 26: State View with AOI Extent Shown**



### Select Existing AOI

The second method for defining the AOI extent is to select a previously defined (existing) AOI. Select the **Select Existing AOI** option and pick an AOI shown in the pull-down scroll list. The AOI boundary will be shown on the State View when you select it from the scroll list. Only a single AOI can be selected. [Figure 27](#) shows an example of the selection method.

**Figure 27: Select Existing AOI Example**

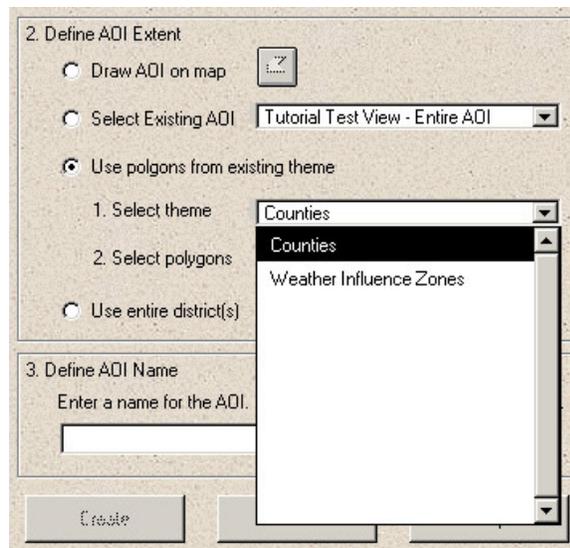


### *Use Polygons From Existing Theme*

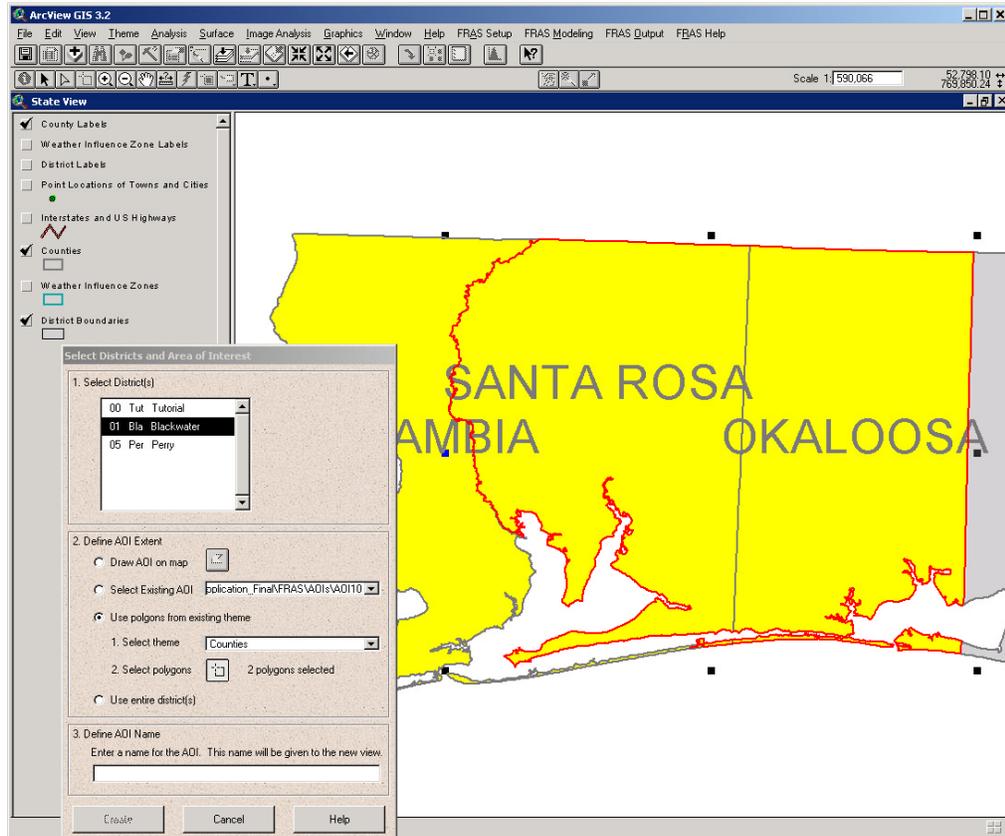
The third method of defining the AOI extent is to select polygons from an existing theme. The theme must be loaded into the State View. Follow these steps:

1. From the pull-down list of available State View themes, select the theme you wish to select polygons from. If the theme does not exist in the view, use the general ArcView **Add Theme** tool to add the theme to the View first. It will then appear in the scroll list. [Figure 28](#) shows an example of selecting Counties.
2. Select the **Select Polygons** button from the dialog and select the theme polygons from the State View. Use the standard ArcView zoom and pan tools to set the view map the way you want. Click on the polygon using the left mouse button. To select multiple polygons hold the SHIFT key and click on the features. [Figure 29](#) shows an example where 2 adjoining County polygons have been selected for the Blackwater District. Note that polygons do not need to be adjacent to be selected. This allows the user to select AOIs that are not connected as long as they exist in an existing theme.

**Figure 28: Select Polygons from Existing Theme - Select Theme Example**



**Figure 29: Select Polygons from Existing Theme – Select Polygons Example**



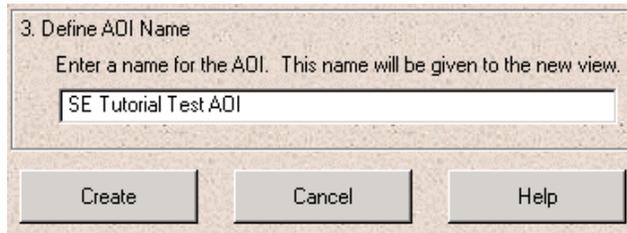
*Use Entire District*

The final method of defining the AOI extent is to select the entire District by toggling the **Use entire District(s)** option.

### Define AOI Name

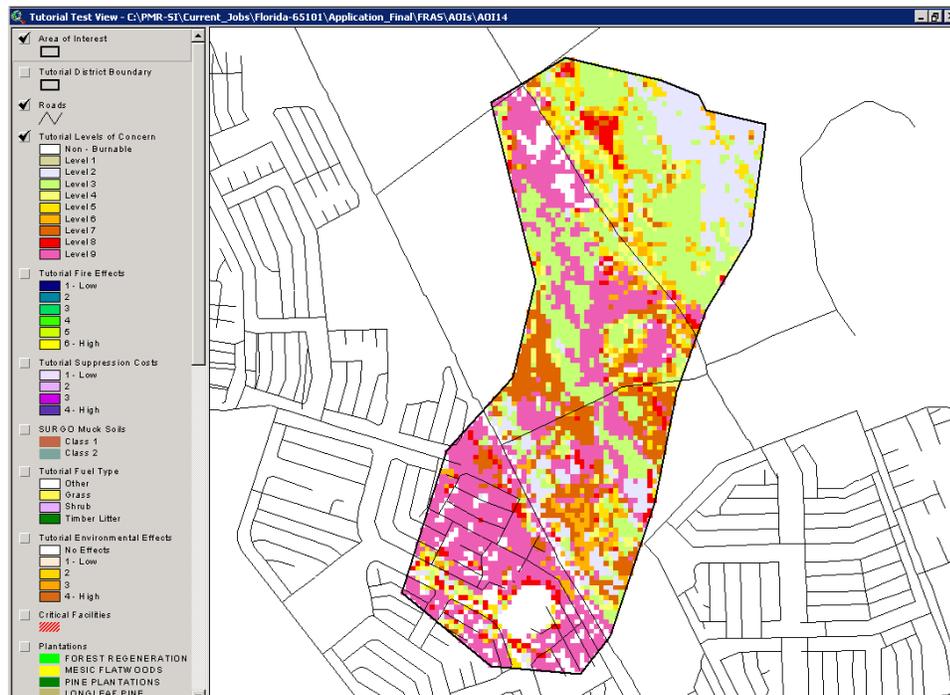
Once an AOI is defined, you must provide a unique name for the AOI you wish to create. Type this name into the input field as shown in [Figure 30](#).

**Figure 30: Define AOI Name Input Example**



Once the name is entered, press the **Create** button. A new data view will be created for the AOI. Input data themes will be clipped to the AOI boundary and loaded into the view as themes. [Figure 31](#) presents an example of the AOI Data View that will be created.

**Figure 31: AOI Data View Example**



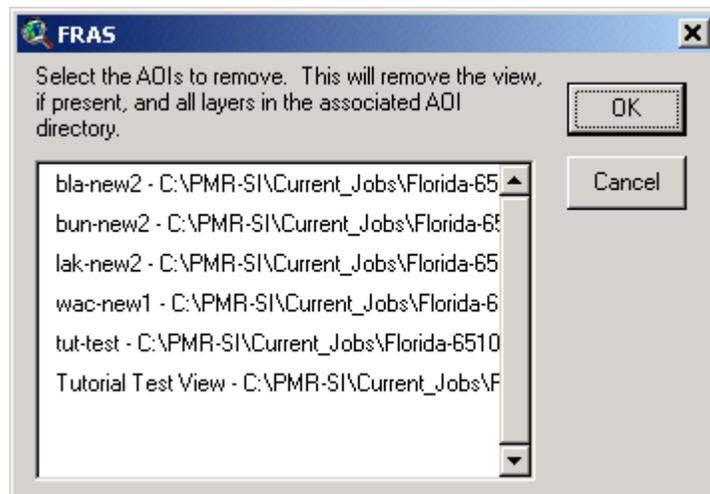
The AOI Data View is now available for use with the analysis tools described in this section. Note that an unlimited number of AOIs can be defined and used but only a single AOI can be active at any time.

### **Removing an AOI**

Once modeling is complete, the user may want to remove an AOI. This should only be done if you do not intend to undertake any modeling in the future for that AOI, and/or you do not need to generate maps or reports for the AOI. If you will need access to the AOI results in the future do not remove it.

To remove an AOI, select the **FRAS** Modeling, **Remove** AOI menu item. This menu item will remove the AOI view and any internal data derived on disk for that AOI. [Figure 32](#) shows this dialog. Note that you can remove more than one AOI at a time by selecting as many AOIs from the list as you like. Once the user clicks OK, they are prompted to ensure the selected AOIs should in fact be deleted.

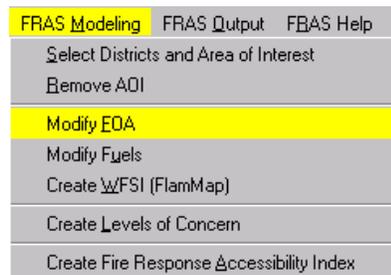
**Figure 32: Remove AOI Dialog**



## Modifying Fire Occurrence Classes

Another option for modifying key input data is to change the Fire Occurrence Classes. This will require recalculation of the WFSI data. The following steps are required to modify FOA classes.

Select the **Modify FOA** option from the **FRAS Modeling** menu.



### **Step 1: Defining Area for FOA Changes**

The first step in modifying the FOA classes is to select an Project Area of Interest (AOI) from the active AOI Data View. An active AOI Data View is required otherwise this modeling option will not be available.

Figure 33 presents the FOA dialog. Click on the AOI icon (button) next to **Draw area where FOA values will be modified**. An AOI polygon can now be digitized in the AOI Data View. Click with the left mouse button to digitize a vertex for the polygon and double click when you are finished. Figure 34 presents an example of a Project AOI boundary after digitizing is complete.

Figure 33: Modify FOA – Define AOI Dialog

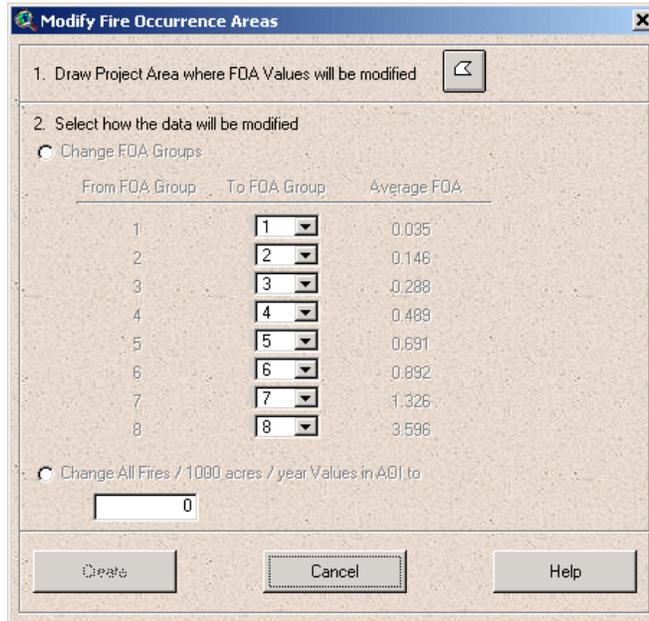
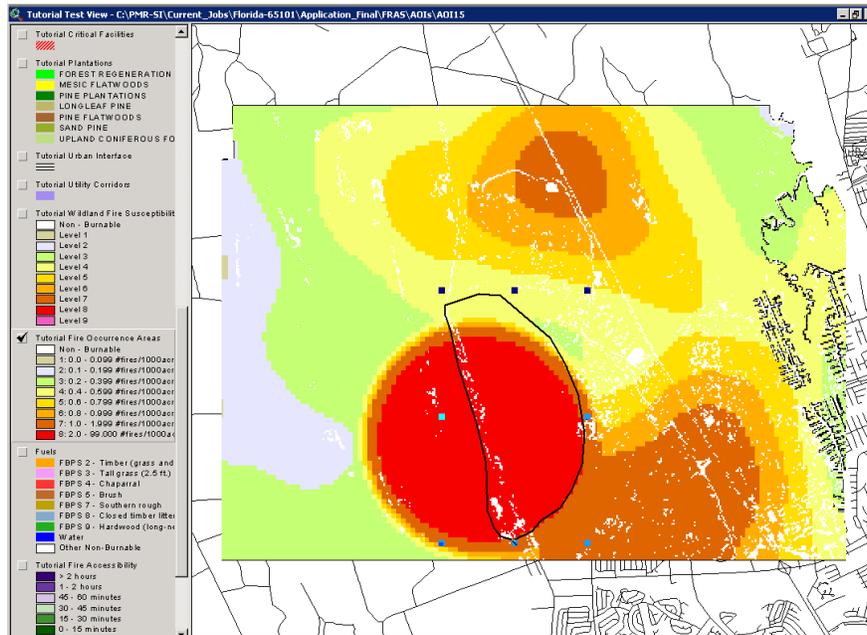


Figure 34: Modify FOA – Define AOI View (FOA Data)



### Step 2: Changing to Another Existing FOA Rate

Once the FOA Project Area AOI has been digitized, the average FOA value for cells within the District is presented in the dialog under the Average FOA column.

Two options are available to change the FOA classes. These are:

1. Change each existing FOA class within the AOI to another standard FOA class (class by class), or
2. Change all FOA classes to a user defined FOA value. Note that the value is in Fires / 1000 acres / Year. For example, to convert all values to FOA class 3, a value of 0.281 would be entered.

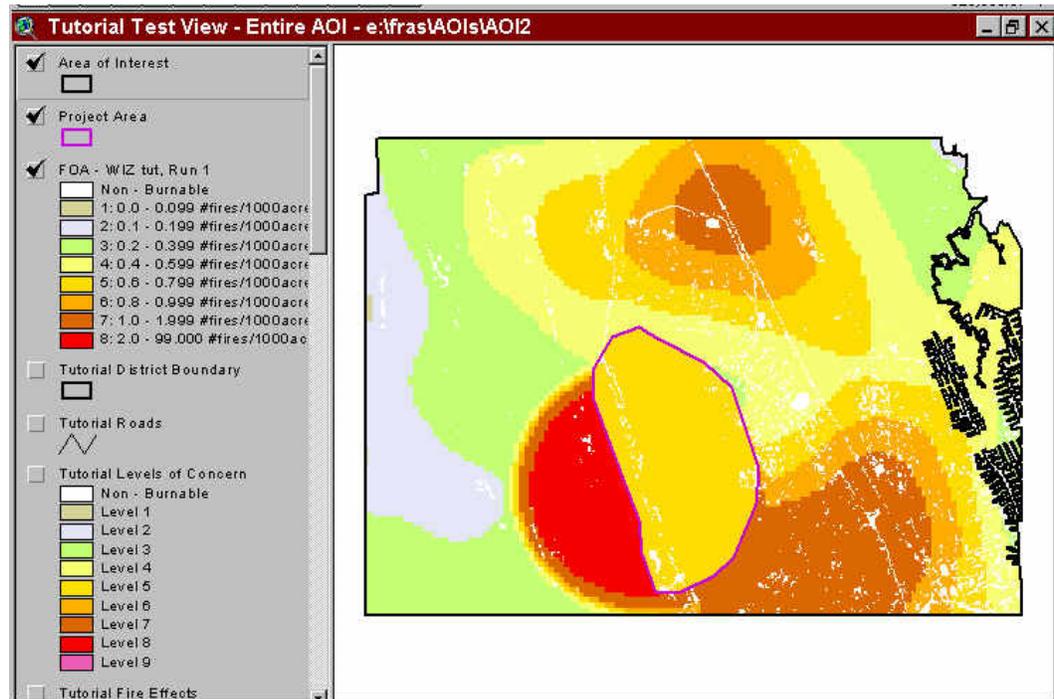
For option 1, select the **Change FOA Groups** option and enter in the new **To FOA group** for each class as shown in [Figure 35](#). Note that in [Figure 35](#), FOA Groups 1 and 2 do not allow the user to enter a '**To FOA Group**'. This is because FOA Groups 1 and 2 do not exist within the Project AOI.

**Figure 35: Modify FOA – Change Rate Dialog**

From FOA Group	To FOA Group	Average FOA
1		
2		
3	3	0.288
4	4	0.489
5	5	0.691
6	6	0.892
7	7	1.326
8	8	3.596

Once the groups have been changed, press the **Create** button to modify the FOA data. Note that the AOI Data View will be updated with the revised FOA theme. [Figure 36](#) presents an example. Note how the FOA values have changed compared to [Figure 34](#). In this example, the new FOA data was recalculated by setting classes 3 through 8 to group 5.

**Figure 36: Modify FOA – Revised FOA Data in View**



### Step 3: Changing to a New User Defined Rate

The second option is to select **Change All fires/1000 acres/year Values in AOI to** and enter a fires/1000 acres/year value.

Figure 37 presents an example. Note that a good understanding of the historical fire occurrence data for the District is required to properly define a user rate.

Figure 37: Modify FOA – User Defined Rate

	From FOA Group	To FOA Group	Average FOA
1			
2			
3			
4		4	0.489
5		5	0.691
6		6	0.892
7		7	1.326
8			

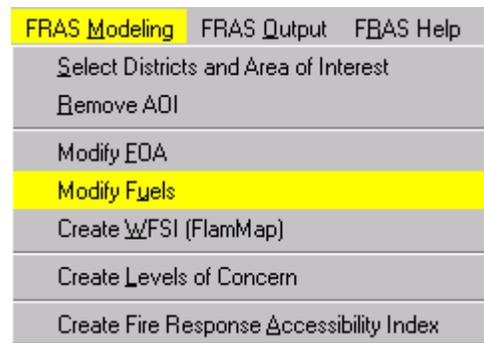
### Step 4: Recreating the WFSI

Now that the FOA classes have been modified, the Wildland Fire Susceptibility Index (WFSI) must be recreated using the new FOA data. Refer to the section on [Deriving the WFSI](#) described in [Section VI](#).

## Modifying Fuels

Another option for modifying key input data is to change the fuel model. This will require recalculation of the WFSI data. Modifying fuel models involves a series of steps that require an understanding of fuel management techniques and impacts.

Select the **Modify Fuels** option from the **FRAS Modeling** menu.



### **Overview of the Fuels Modification Logic**

In order to effectively utilize FRAS for fuels management and mitigation, a fuels modification tool was developed. This tool allows the user to modify fuel models for a specific Project AOI, display the output(s), and use the updated fuel layer(s) to recreate the Wildland Fire Susceptibility Index (WFSI) and/or the Level of Concern Index following a fuels treatment.

Because fuels do not immediately return to their pre-treatment state, it was determined that the expected FBPS fuel model or custom FBPS derivative fuel models would be determined for each of 10 years following a fuel treatment. A workshop was facilitated with DOF personnel who have extensive field experience in fuel assessment and treatment to:

1. Define fuel situations in Florida where fuels treatment might be considered,
2. Define the fuel treatment types, i.e.: broadcast prescribed fire, pile and burn, etc.,
3. Define the characteristics of the fuel profile following fuel treatment for each fuel situation and each fuel model,

4. Assign a FBPS fuel model or custom FBPS derivative fuel model to the post-treatment fuel profiles, and
5. Develop the expected FBPS fuel model or a custom FBPS derivative fuel model for 10 years following treatment for each post-treatment fuel profile.

The following table gives an example of the profiles developed at the workshop. It assumes use of a broadcast prescribed fire in a fuel model 4.

			Years Since Treatment									
Broadcast Prescribed Fire	Pre-Treat.	Post-Treat.	1	2	3	4	5	6	7	8	9	10
Fuel	4	4N	5	7A	7	7Z	4A	4	4	4Z	4Z	4Z

In order to provide flexibility when developing the fuel profiles over time, custom FBPS derivative fuel models were developed to complement the existing 13 fuel models. A custom FBPS derivative fuel model is a custom fuel model that minimizes, reduces, or increases fuel loading and fuel bed depth for each of the original FBPS fuel models. By altering the fuel loading and fuel bed depth of the existing fuel models consistently, the characteristic surface area to volume ratio and the relative packing ratio are preserved. Minor modification can occur to fuel bed depth also within these constraints extending the concept to model unusually “fluffy” or “compact” fuel beds.

Below follows a description of the set of custom FBPS derivative fuel models that were developed for the FRAS fuels modification tool.

#### *Low Derivatives of the FBPS Fuel Models 1-12*

For each FBPS fuel model, a low version was developed by reducing the fuel loading in each category by 30% and by reducing the fuel bed bulk depth by 30%. The consistent reduction in depth and loading maintains the fuel bed bulk density and characteristic (average) surface area to volume ratio for the fuel bed. The low derivative fuel models are designated with the letter 'A' following the standard fuel model number. For example, a 1A is the low loading version of a FBPS fuel model 1.

#### *High Derivatives of the FBPS Fuel Models 1-12*

For each FBPS fuel model, a high version was developed by increasing the fuel loading in each category by 30% and by increasing the fuel bed bulk depth by 30%. The high derivative fuel models are designated with the letter Z following the standard fuel model number. For example, a 1Z is the high loading version of a FBPS fuel model 1.

#### *Low Spread Derivatives of the FBPS Fuel Models 1-12*

For each FBPS fuel model a low spread version was developed by minimizing the fuel loading and fuel bed depth in each category. A rate of spread of about 1 chain / hour can be expected using the weather in the Extreme Percentile Category. The low spread fuel models are designated with the letter N following the standard fuel model number. For example, a 1N is the low spread version of a FBPS fuel model 1.

While the user does have the ability to modify the output fuel profiles, it is strongly recommended the default profiles be used unless the user has extensive knowledge in fuel treatment and assessment.

A step-by-step description follows on how to use the fuel modification tool.

#### **Step 1: Defining an Area for Fuel Modification**

The first step is to digitize an Project AOI for modifying fuels in the AOI Data View. If a Project AOI is not defined, the entire model view AOI will be used. Since this fuels modification tool is intended to reflect operational treatments, it is highly recommended that Project AOIs be used.

Press the AOI icon (button) to the right of the **1. Draw area where fuels will be modified** prompt occurs. Consistent with other AOI tools within FRAS, digitize the Project AOI on the AOI Data View. Double click to finish the polygon. [Figure 38](#) presents the fuels modification dialog. Once the Project AOI is defined, select a type of treatment (next step). [Figure 39](#) presents an example of the AOI Data View with the Project AOI digitized for fuels. Note that fuels theme is automatically brought to the top of the view.

**Figure 38: Modify Fuels – Define AOI and Select Treatment**

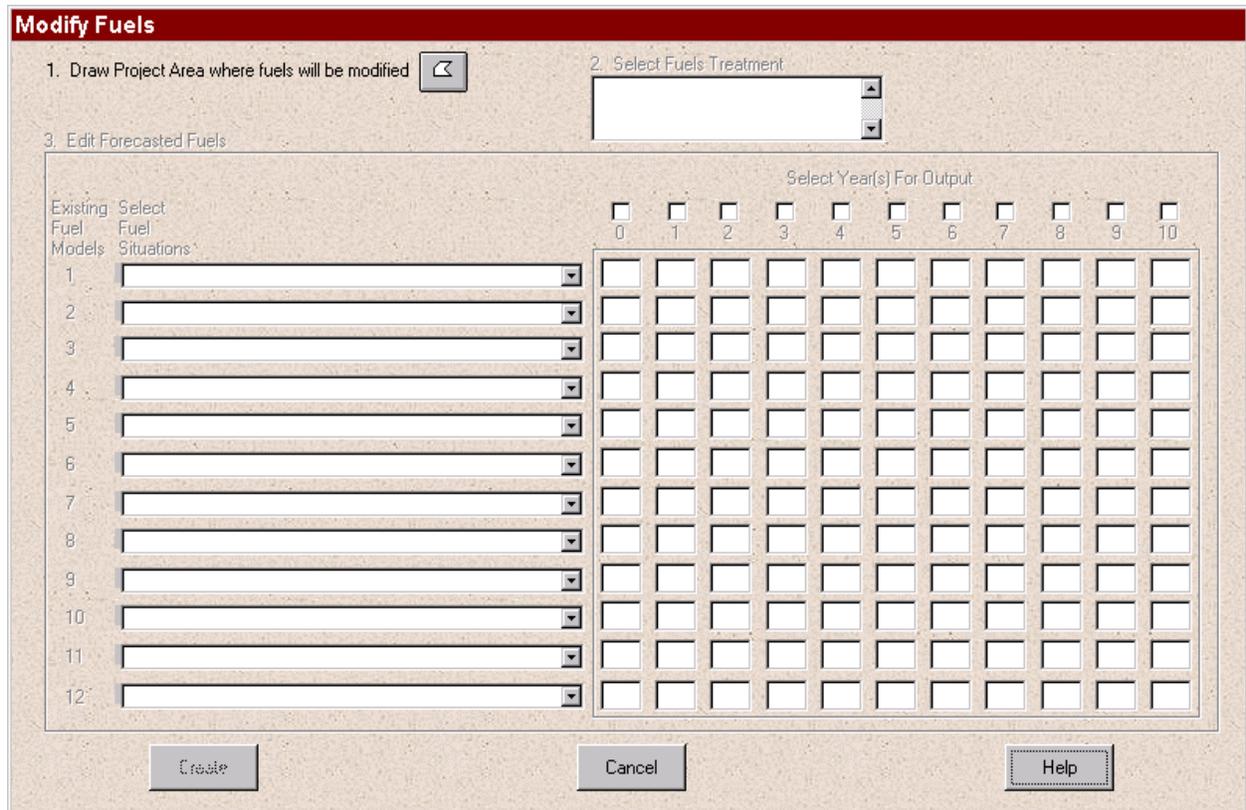
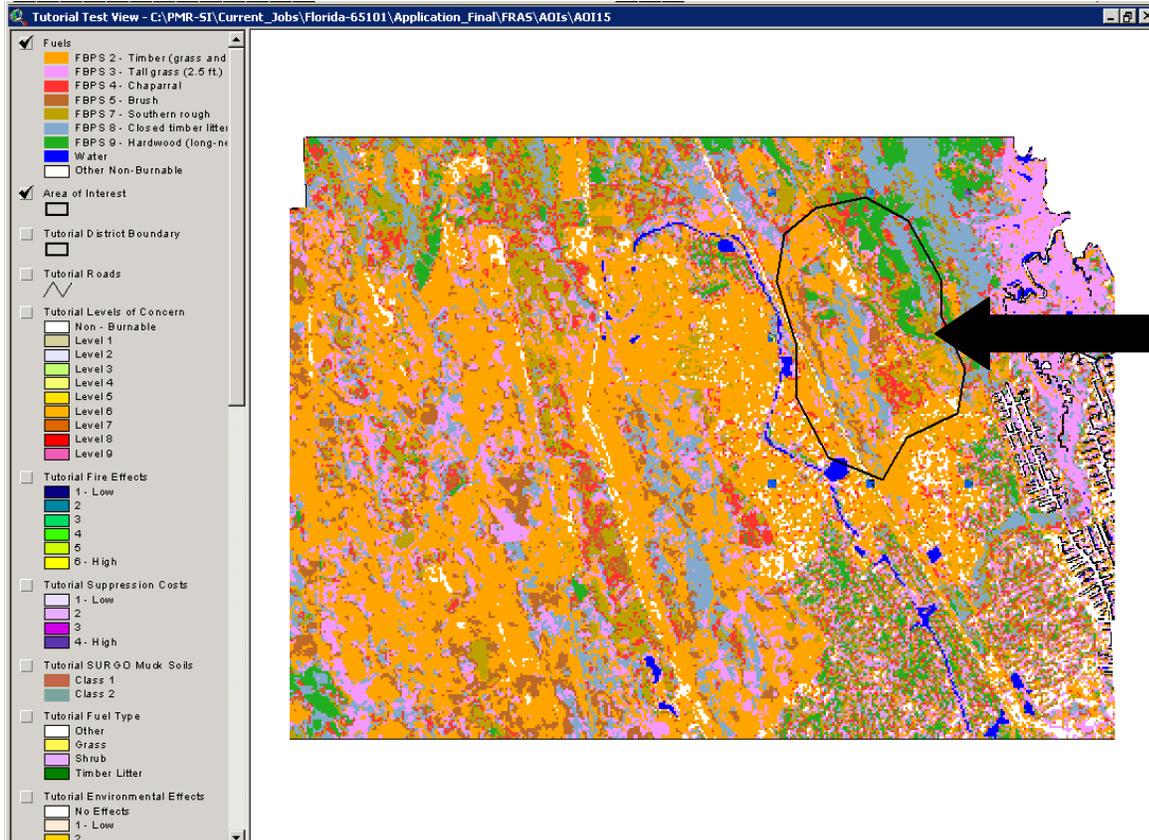


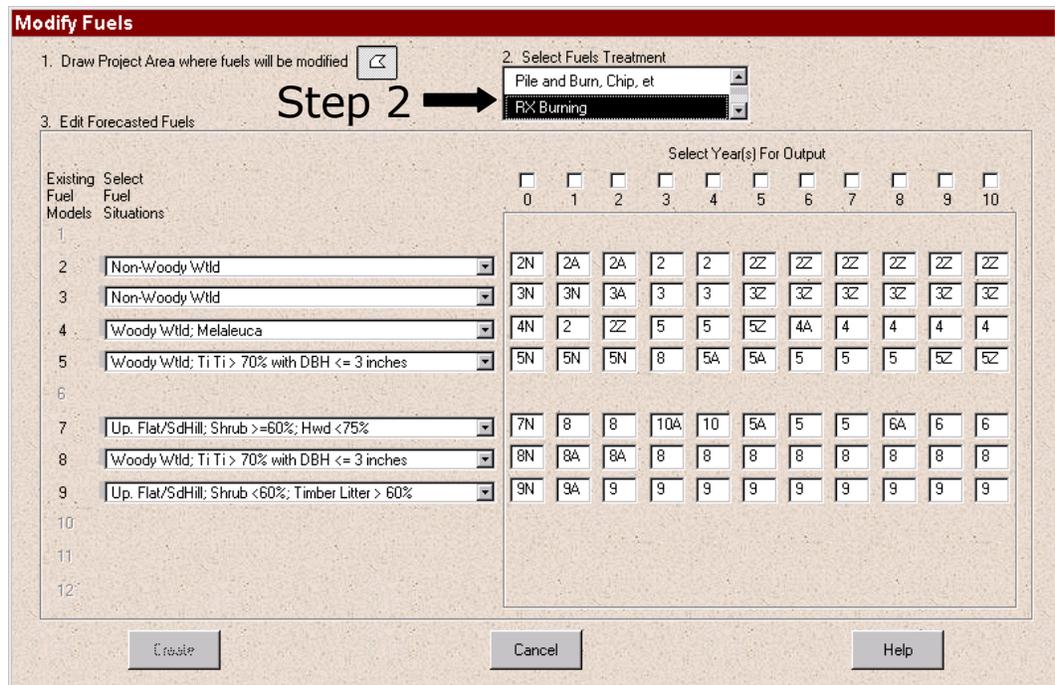
Figure 39: Modify Fuels – AOI Map View



**Step 2: Selecting the Type of Treatment**

Select the type of fuel treatment for the Project AOI by using the scroll list options in **2. Select Fuels Treatment**. Once a treatment is selected, the post treatment fuel situations are automatically populated for that fuel treatment for each fuel model in the **3. Edit Forecasted Fuels** dialog area (see [Figure 40](#)).

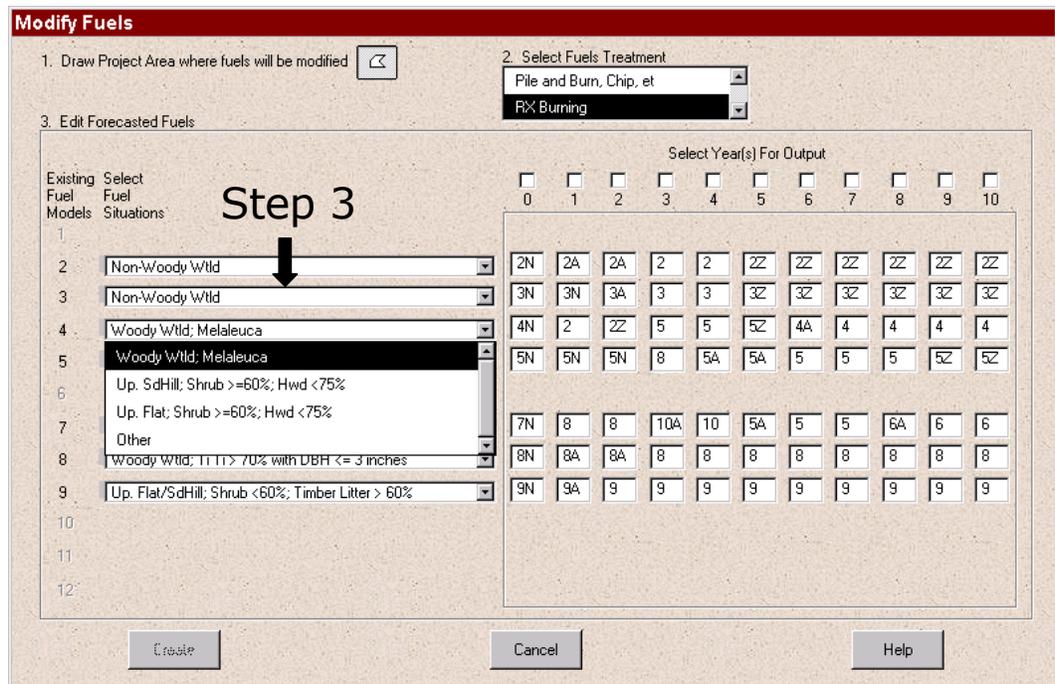
**Figure 40: Modify Fuels – Select Type of Treatment**



**Step 3: Selecting Fuel Situations For Each Fuel Model**

This step involves reviewing the available fuel situations for each fuel model and selecting the appropriate fuel situation from the list for the first fuel model. This is illustrated in [Figure 41](#). Once the fuel situation is selected, the fuel profiles for selected fuel situations will appear within the dialog box. The next step demonstrates how these fuel profiles can be modified.

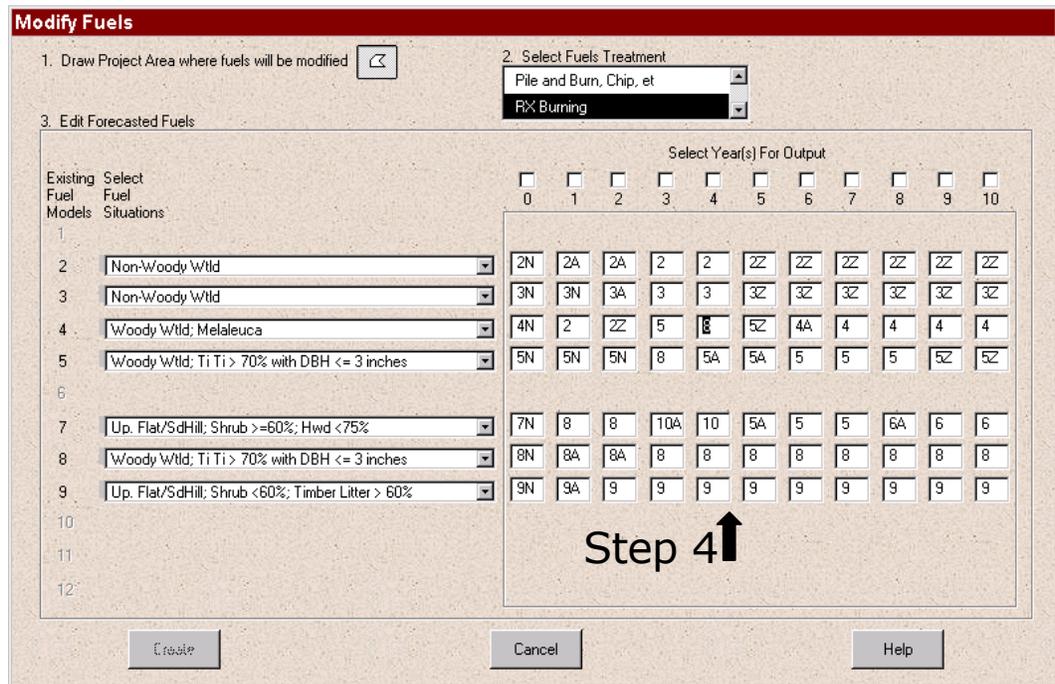
**Figure 41: Modify Fuels – Select Fuel Situations**



### Step 4: Modifying the Fuel Profiles

This step allows the user to modify the fuel profiles for the specific fuel situation. Any of the years (0-10) can be modified and are automatically applied to the Project AOI. Type in new fuel models for those years you wish to change. Note that a panel of experts has derived the fuel profiles during workshops for the FRAS project. Accordingly, any changes to the output fuel models should be made based on a detailed knowledge of the local AOI. Also, note that the range of fuel models from year 1-10 represents a scenario. A change in 1 year will require potential changes in subsequent years. If FRAS does not recognize a fuel model, i.e. it does not exist on our look-up tables, the user will be prompted with a dialog message saying the fuel model does not exist. To see a list of valid fuel models, hit the **enter** key at any time within any of the fuel model text boxes and a drop-down list of valid fuel models will pop-up.

Figure 42: Modify Fuels – Modifying Fuel Profiles



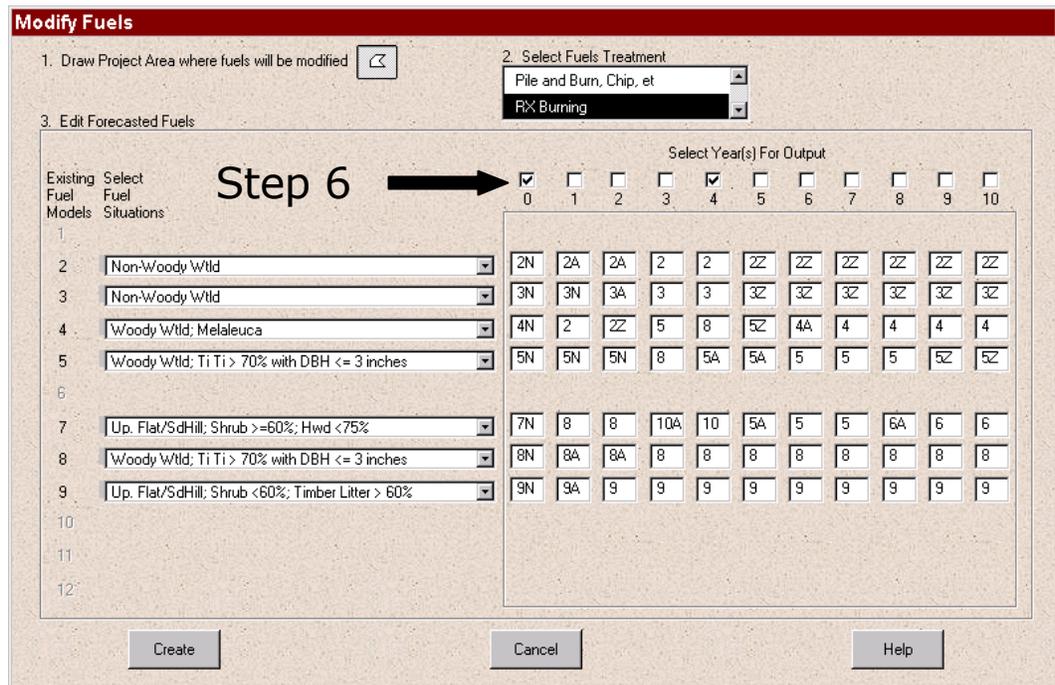
**Step 5: Repeating The Process For All Fuel Models.**

The next step is for the user to identify the appropriate fuel situation for the remaining fuel models found in the Project Area of Interest, and modify the fuel profile for any given year (0-10). See [Steps 3](#) and [4](#).

**Step 6: Selecting the Year**

Select a single year, or multiple years for which a new fuels map is desired.

**Figure 43: Modify Fuels – Selecting the Year**



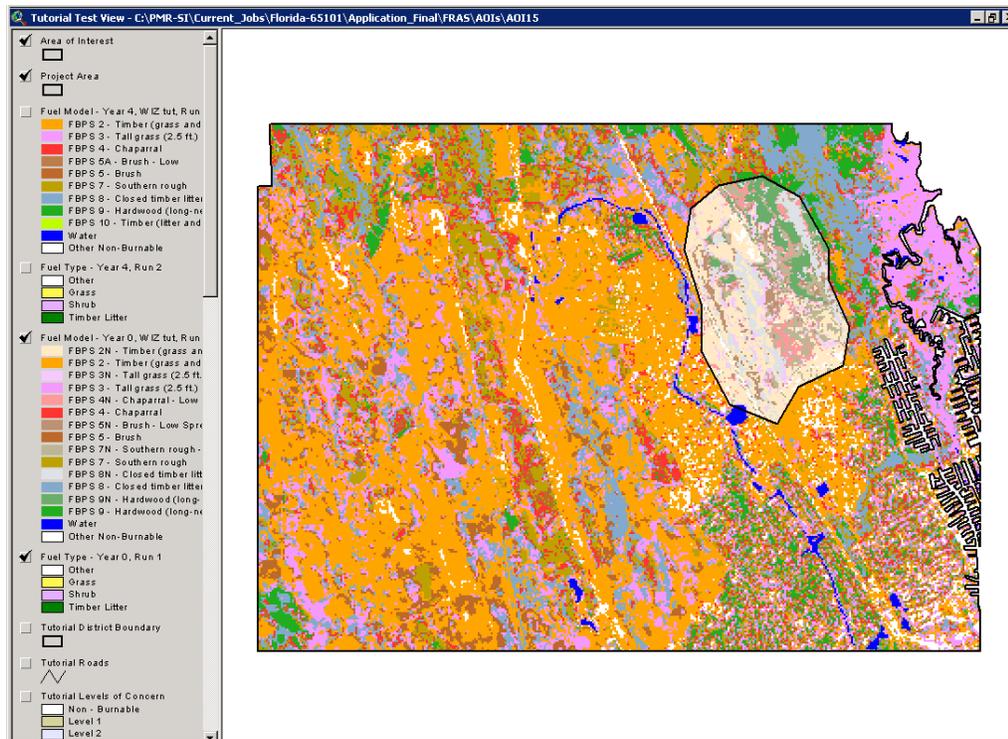
**Step 7: Generating the New Fuel Model Output**

This step will allow you to generate a new fuel model output for the fuel treatment Project AOI you have defined, and overlay this modified fuels onto the original fuels map for the Project AOI (i.e. paste into original fuels map to create a new fuels map).

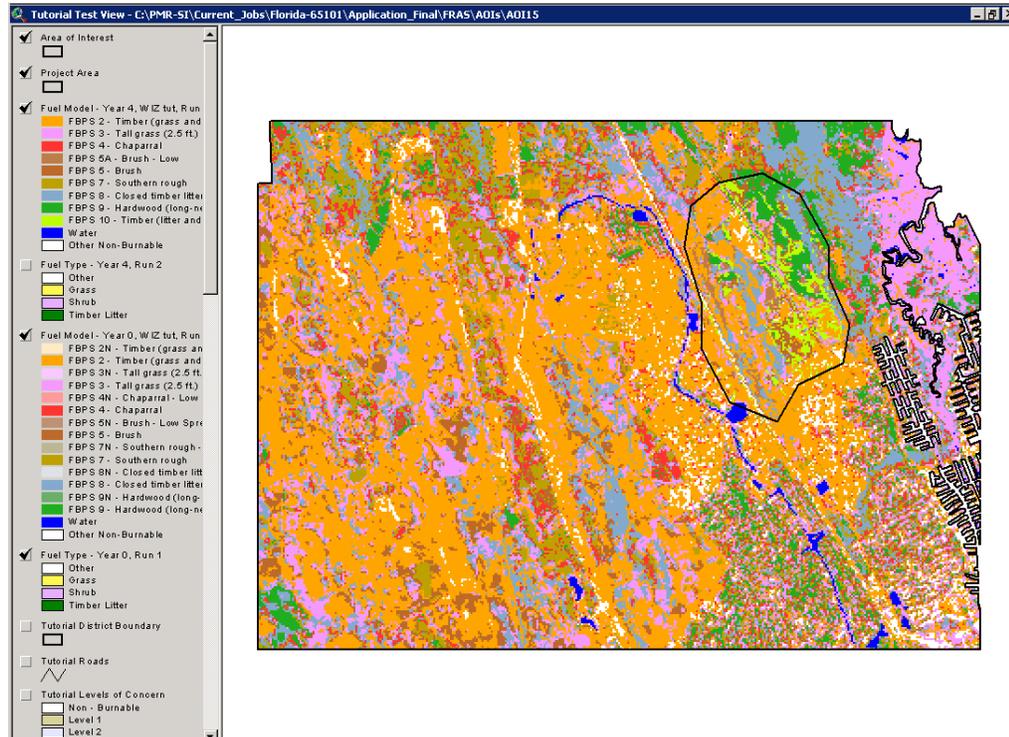
Pressing the **Create** button will create new fuel layers for the selected fuel profile years and output in the AOI view. The new fuel layers are then available as inputs into FlamMap to generate a new WFSI (see Step 8).

Figure 44 presents an example of the year 0 output from the fuels modification. Figure 45 presents a year 4 output from the fuels modification.

**Figure 44: Modify Fuels – Year 0, Modified Fuels for AOI**



**Figure 45: Modify Fuels – Year 4, Modified Fuels for AOI**



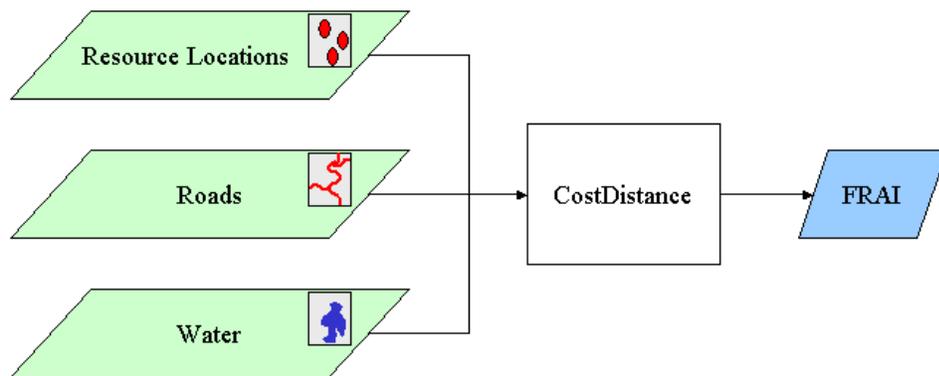
### **Step 8: Recreating the WFSI**

Now that the fuels layer has been modified, the next step is to recreate the Wildland Fire Susceptibility Index (WFSI) using the new Fuels data. Refer to the section on [Deriving the WFSI](#) described in [Section VI](#).

## Updating Resource Locations

The ability to analyze accessibility by changing Resource Locations is also available. However, no custom tool is provided to facilitate this capability, as it is readily available using the general ArcView editing functions. Accordingly, this section describes the steps that are required to update Resource Locations for generating the Fire Response Accessibility Index. [Figure 46](#) presents the data processing flow for the FRAI data. Updating the Resource Locations dictates an update to the FRAI layer.

**Figure 46: The FRAI Processing Flow**



Follow the steps described below to modify the existing resources location data.

### ***Step 1: Ensuring District Resource Locations Data is Loaded into the Active AOI Data View and saved to the AOI Directory***

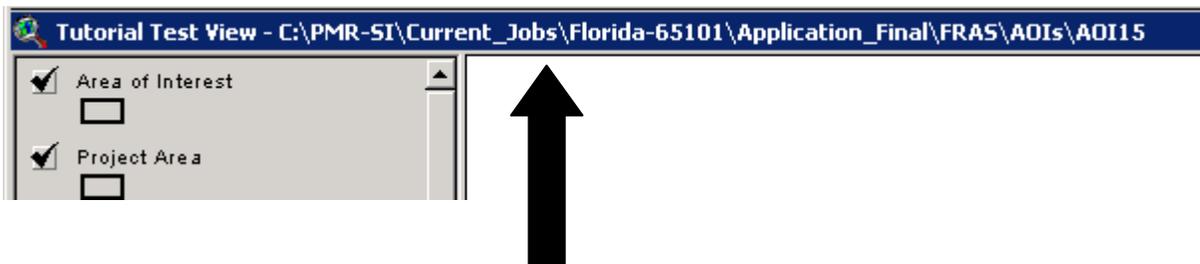
Updating the Resource Locations must occur in an active AOI Data View. Select the AOI Data View for the area in which the Resource Locations are to be modified. Ensure the Resource Locations theme exists. Resource Locations are clipped to an 8-mile buffer around the AOI extent during creation of the AOI Data View.

The original source Resource Locations data resides as a coverage found in each District folder. For example, for the Blackwater District, the Resource Locations data file will be "blarsrc". Resource Locations always have the "rsrc" naming convention. Refer to the metadata provided with

the Published Results data distribution found in the "FRAS\Districts\_Metadata" folder.

When an AOI is created, the Resource Locations are clipped to the AOI and copied to the AOI folder. Since the AOI folders are managed seamlessly by FRAS, it will be necessary to determine which specific AOI folder is being used for the view (this is required in the next step). To provide this information to the user the specific AOI folder is incorporated into the View name. The View Name consists of the AOI name – full AOI folder path name. [Figure 47](#) shows an example of the AOI folder path name within the View Name.

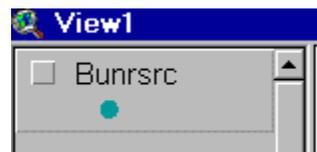
**Figure 47: View Name Showing AOI Folder Path Name.**



Once the location of the specific AOI folder is known, proceed with creating a copy of the Resource Locations shapefile and updating it.

### ***Step 2: Selecting the Existing Resource Locations Theme***

Select the Resource Locations theme in the view legend by placing the cursor over the name and clicking the left mouse button. The box around the name of the resource location coverage should be outlined as shown below.



### Step 3: Converting to a Shapefile

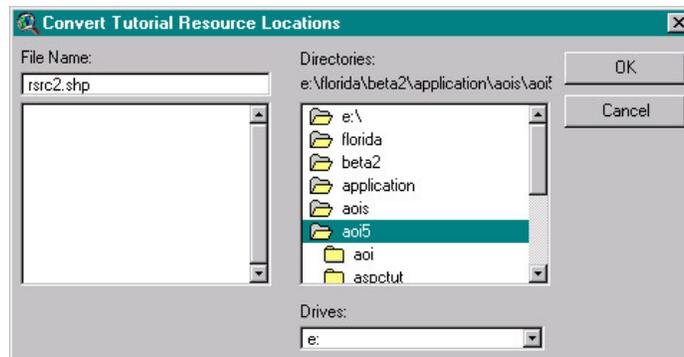
The theme must be converted to a shapefile to facilitate editing. This will make a copy of your resource locations. To convert the theme to a shapefile, click on the ArcView **Theme** menu and select **Convert to Shapefile** shown in [Figure 48](#).

Figure 48: ArcView Theme-Convert to Shapefile Menu Option



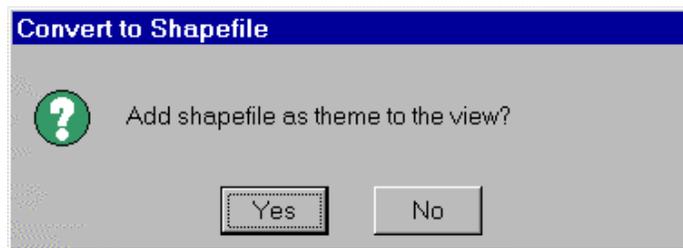
FRAS will prompt for the path to the new shapefile. Navigate to the specific AOI folder determined in [Step 1](#) and save the new shapefile using the **"rsrc#.shp"** naming convention where the **#** can be a unique sequential number to help you identify other resource location data sets. As long as the string, 'rsrc' exists within the name, FRAS will recognize it as a Resource Locations data set and will include it in the list of data layers. [Figure 49](#) presents an example dialog.

Figure 49: Resource Locations – Save Shapefile Dialog



Using a sequential numbering scheme will allow for the creation of many resource location modification data sets. This would allow for comparison of different scenarios for allocation with respect to the final impact on fire accessibility.

You will then be prompted to “**Add shapefile as a theme to the view?**”. Press the **Yes** button to add the new shapefile as a theme to the AOI Data View (see below).

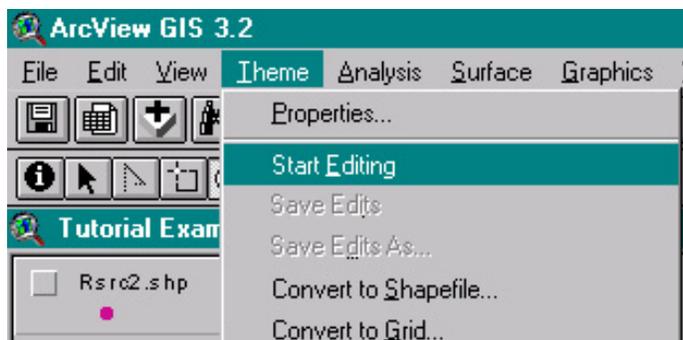


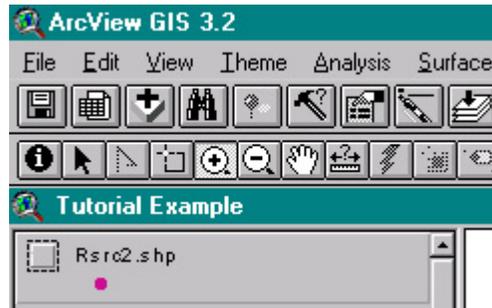
Now one can start editing the Resource Locations by adding new resource locations, moving existing resource locations, or removing resource locations.

#### **Step 4: Start Editing**

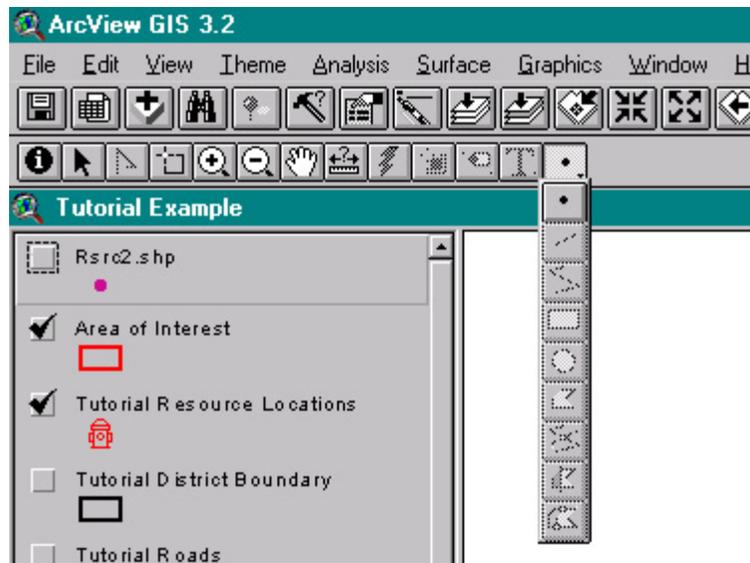
Select the new shapefile theme that has just been added to your AOI view. Now select the ArcView **Theme-Start Editing** menu option (Figure 50). A dashed line will appear around the check box in the view legend when the theme is ready for editing (Figure 51).

**Figure 50: Resource Locations - Start Editing Menu Option**



**Figure 51: Resource Locations – Theme Ready for Editing Example****Step 5: Digitizing New Locations**

To insert a new resource location, select the point tool from the tool drop-down menu as shown in [Figure 52](#). The cursor should now appear as a crosshair on the screen.

**Figure 52: Resource Locations - Point Editing Tool**

Place the cursor on the map where you would like the new resource location and click the left mouse button once to place the point. The new point will be added to the shapefile and become the selected feature as shown in [Figure 53](#).

**Figure 53: Resource Locations – Digitizing a Point Location**



Many new locations can be added in this manner using this approach.

### ***Step 6: Moving Existing Locations***

To move a resource location the pointer tool must first be selected.



Using this tool, depress and hold the right mouse button until the point is at the desired location in the shapefile. This is a drop-and-drag operation.

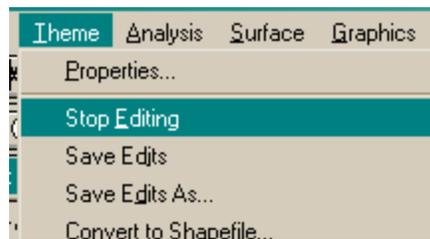
### ***Step 7: Removing a Location***

To remove a resource location point from the shapefile, place the pointer tool over the resource location to be removed and click the left mouse

button once. The resource location should appear as selected. To delete the selected resource location, press the delete key on the keyboard.

### **Step 8: Stop Editing**

Once editing is complete, select the **Theme-Stop Editing** menu option. The program will prompt to confirm saving edits. Press **Yes** to save the edits.



### **Step 9: Recreating the FRAI**

Now that the Resource Locations have been edited, the FRAI may be recreated using these new locations. Refer to the section on [Deriving the FRAI](#) described in [Section VI](#).

## VI. Deriving FRAS Model Outputs

This section reviews the modeling capabilities provided in FRAS for deriving the following outputs:

1. Wildland Fire Susceptibility Index (WFSI),
2. Levels of Concern (LOC), and
3. Fire Response Accessibility Index (FRAI).

These outputs can be derived for any AOI Data View that is active. Using the data modification tools described in the previous section, users can analyze mitigation options to assess the effectiveness in changing wildland fire risk. Comparisons can be made with the Published Results data.

The ArcView Spatial Analyst module is required to calculate the Fire Response Accessibility Index (FRAI) and the Wildland Fire Susceptibility Index (WFSI). The Levels of Concern (LOC) can be calculated whether or not the user has the ArcView Spatial Analyst module installed, however processing time is greatly reduced with the module.

### Deriving the Wildland Fire Susceptibility Index (WFSI)

A key output for the Fire Risk Assessment is the WFSI. The user is provided the ability to recreate this output. Select the **Create WFSI (FlamMap)** option from the **FRAS Modeling** menu.

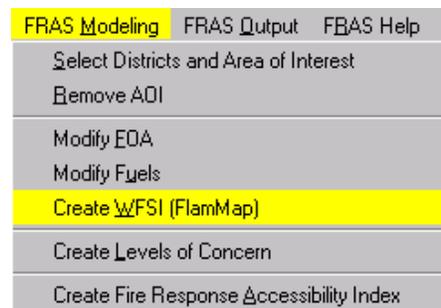
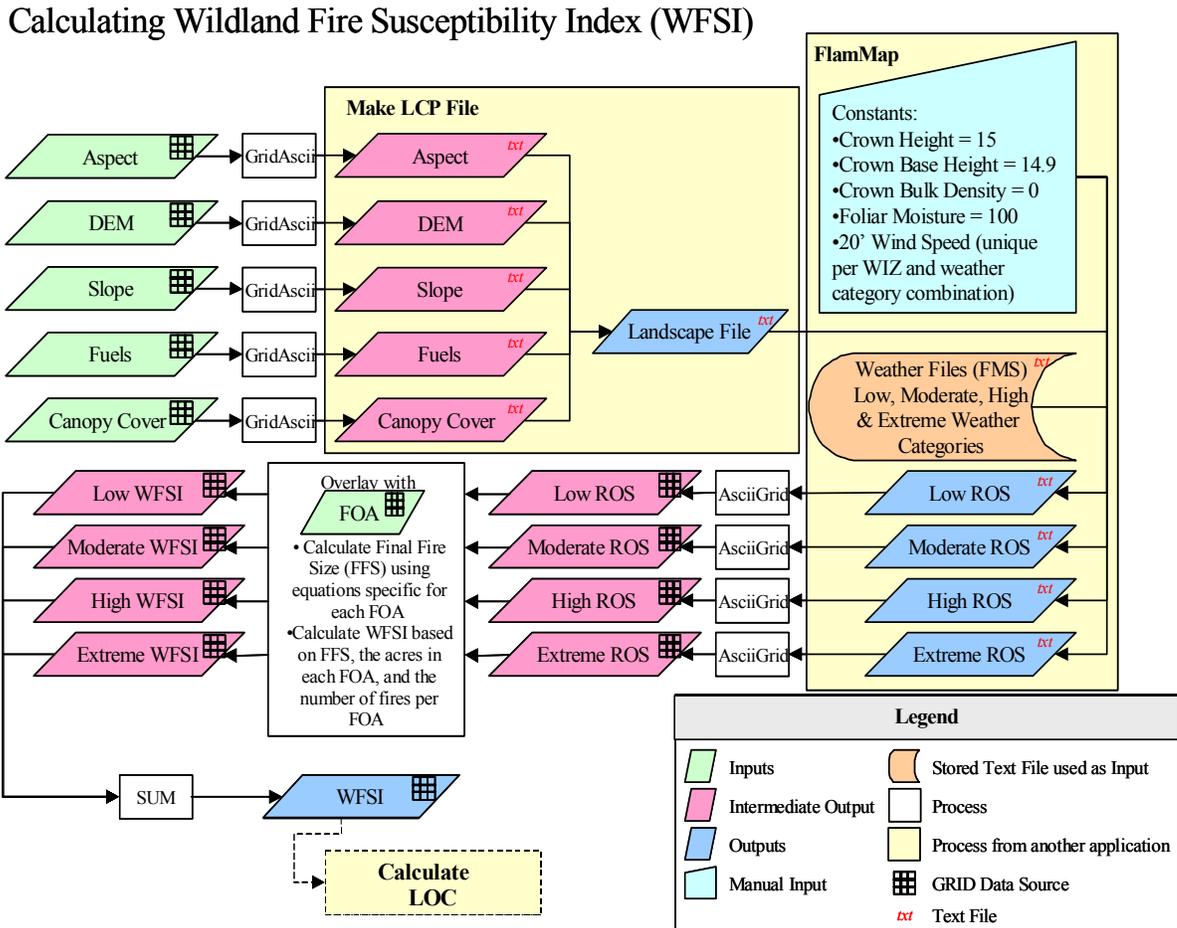


Figure 54 presents a data flow for the WFSI model. This model uses the FlamMap program to calculate Rates of Spread for different fire weather

scenarios, combined with an ArcView Spatial Analyst raster analysis model to derive the final WFSI output. The WFSI model must be rerun in any of the following situations occur:

- Source base data changes, such as DEM (including Slope and Aspect), canopy cover and/or fuels,
- Fire Occurrence Areas (FOAs) have been modified,
- Fuels have been modified, and/or
- Fire behavior constants (crown height, crown base height, crown bulk density, foliar moisture and 20' wind speed), or parameters (Aspect, DEM, Slope, Fuels, and Canopy Cover) are changed requiring new Rates of Spread for the different fire weather scenarios to be generated.

Figure 54: The WFSI Data Flow



The modeling capabilities within FRAS provides tools to support any of these data modification scenarios specifically for a user defined AOI. Accordingly, all WFSI calculations are done in the AOI Data View.

### Overview of the FlamMap Program

FlamMap is a standalone Windows program used to calculate the rate of spread (ROS) and other fire behavior outputs given certain characteristics of the landscape. Within FRAS, ROS is specifically required as a key input layer for calculating the Wildland Fire Susceptibility Index (WFSI) layer.

WFSI is then used as a key layer required to calculate the final Levels of Concern (LOC) data.

ROS is calculated using the following input layers:

1. Digital elevation data (DEM)
2. Aspect (derived from DEM)
3. Slope (derived from DEM)
4. Fuels
5. Tree canopy cover
6. Crown height as a constant
7. Crown base height as a constant, and
8. Crown bulk density as a constant

This data is input as ASCII grid files into FlamMap to generate a landscape file. The ASCII format grid files are generated using an ArcView GRIDASCII function.<sup>4</sup> An internal FlamMap process then converts all data into an internal binary file (.LCP) ready for FlamMap processing. The LCP file is then used with user predefined weather files and 20' wind speed data per weather percentile category to generate ROS. The percentile weather data for a WIZ is used. For more information, refer to section [Weather Influence Zones](#) in chapter 2.

ROS is calculated for each of the percentile weather categories:

1. Low,
2. Moderate,

---

<sup>4</sup> GRIDASCII format is the ASCII exchange format defined by ESRI to facilitate the import and export of raster data to the proprietary GRID binary format. FlamMap supports the GRIDASCII format as a valid input format, and automatically creates output data in this format. This allows data to be exchanged between ESRI software and the FlamMap program. A data conversion function is required before and after running FlamMap as part of the FRAS application.

3. High, and
4. Extreme.

A single FlamMap run is required for each percentile weather category. For example, one run is required to create a Low ROS output data file, another run for a Moderate ROS output file, and so on. This results in four separate output ROS files. The same landscape file is used for each ROS category run. However, **the 20' wind speed constant values and fuel moisture files (FMS) are different for each weather category and must be input as specific parameters.** FMS data files for each percentile weather category for each WIZ are predefined and provided.

In addition, the source Weather Influence Zone (WIZ) data is divided as separate regions within the state. The State of Florida is comprised of 20 WIZs. These WIZ regions do not coincide with the Division of Forestry District boundaries. Accordingly, for each District there may be more than one WIZ. You must run FlamMap for each ROS category for each WIZ.

For example, for the Blackwater District there are two separate WIZs, 1 and 2. Four ROS files (low, moderate, high and extreme) must be calculated for each WIZ. Accordingly, FlamMap must be run 8 times to produce ROS data that will provide adequate coverage for the Blackwater District. Functions within FRAS will then use all 8 ROS data files to create the final WFSI data layer. Final FRAS outputs can then be summarized on a per District basis.

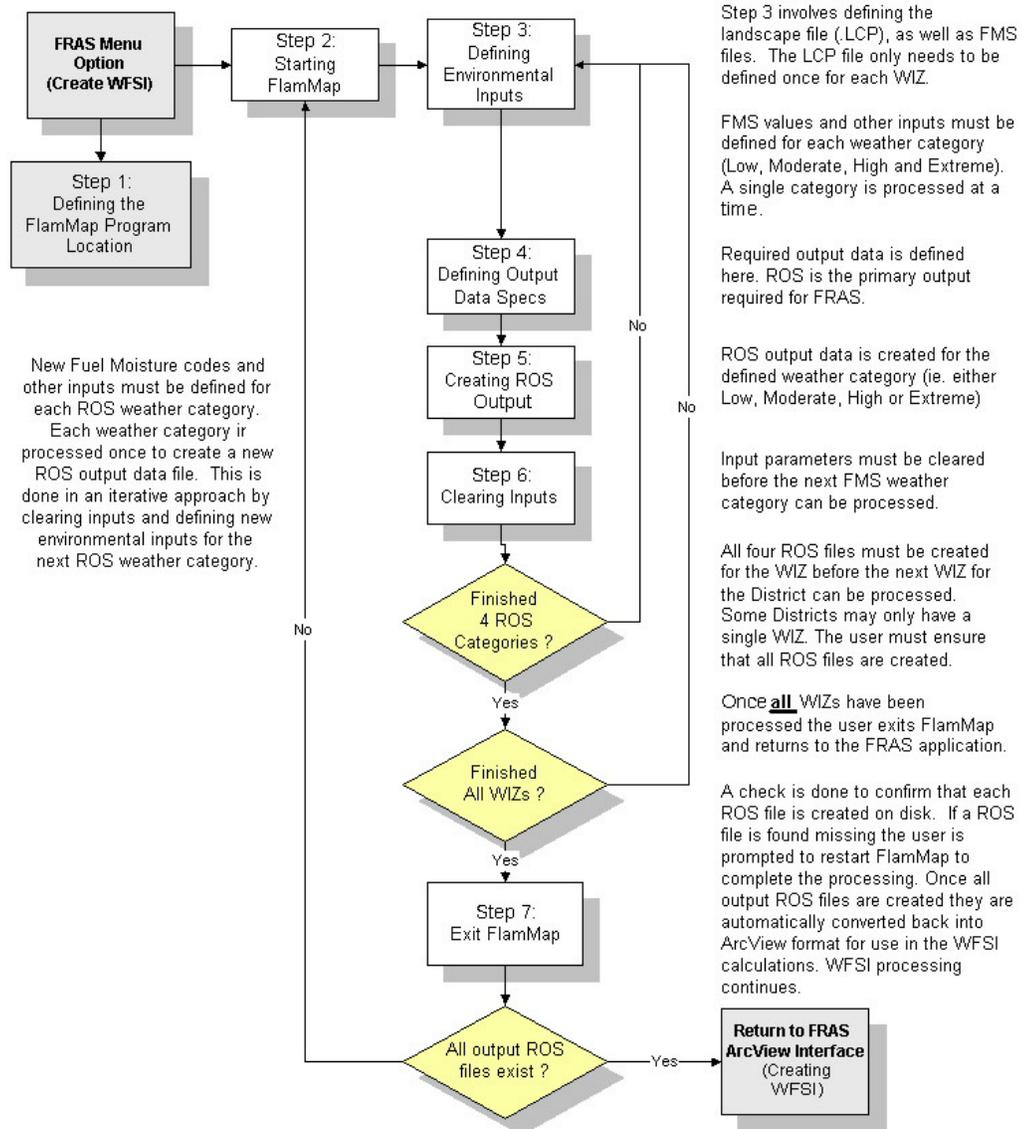
Depending on the AOI defined, the output data files can be large and can take some time to create. For an entire WIZ, the FlamMap LCP file can range from 100 to 400 MB. The ROS output files created by FlamMap can range from 35 to 200 MB each.

Since FlamMap is an external standalone program, (i.e. not developed within ArcView), the user must utilize the FlamMap program Windows interface to create the ROS files. Accordingly, there are a series of processing steps within FlamMap that must be satisfied to create each of the ROS files for each WIZ, within the AOI. [Figure 55](#) presents the process flow for creating these ROS files with FlamMap. Note the iterative processing that is required at the end of each run to ensure that each ROS weather scenario is run for each WIZ within your AOI. This figure is followed by a step-by-step description of the FlamMap processing steps.

Figure 55: The FlamMap ROS Process Flow

### FRAS FlamMap ROS Processing Steps

The FlamMap program is automatically started from the FRAS ArcView application when the "FRAS Modeling-Create WFSI" menu option is selected. FlamMap processing is required each time changes are made to the Fuels or Fire Occurrence data layers if the WFSI is to be recalculated.

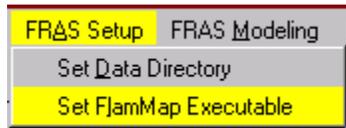


### **Step 1: Define the FlamMap Executable (Program) Location**

FRAS automatically searches the computer for the FlamMap executable in the most likely places, such as the computer's registry and C:\Program Files\FlamMap. If the executable is not in the registry nor is it in the C:\Program Files\FlamMap directory, the user will be prompted to locate the **flammap.exe** program file. Once this is defined, the user will never have to set this parameter again unless either FRAS or FlamMap is reinstalled.

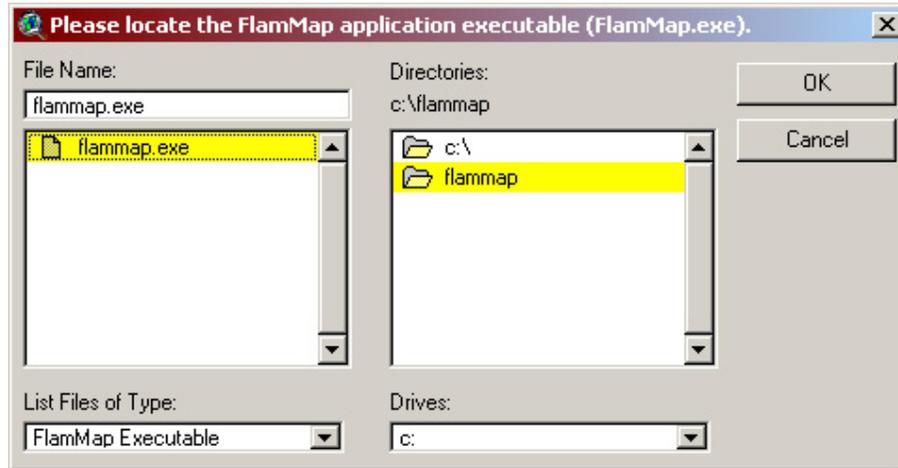
However, in order to accommodate the flexibility of changing the FlamMap program location in the future (i.e. specifically for new FlamMap versions), a menu item is provided that allows you to specify the location.

To set the location, select the **Set FlamMap Executable** option from the **FRAS Setup** menu.



Once the menu option is selected, a file browser tool opens allowing the user to navigate to the **flammap.exe** file

Figure 56 illustrates the use of the file browser to define the location of the **flammap.exe** file.

**Figure 56: Navigating To The FlamMap Program Path****Step 2: Starting FlamMap Through FRAS**

FlamMap is a separate standalone Windows program that operates external to the ArcView FRAS application. Due to limitations with the design of the current version of FlamMap, technical opportunities for tight integration are restricted. Accordingly, FlamMap must be operated as a separate program. FRAS currently integrates with FlamMap in the following manner:

- 1) Converts GIS data layers to ASCII format,
- 2) Generates a Landscape file for use in FlamMap<sup>5</sup>
- 3) Utilizes a standard 'working' directory for all input and output data to aid the user in defining data for FlamMap operation,
- 4) Starts FlamMap as a separate shell session. The FRAS ArcView application is disabled while FlamMap is in operation, and
- 5) Converts FlamMap output ROS ASCII data back into GIS format ready for use with FRAS. This data is automatically loaded as

---

<sup>5</sup> The Landscape file (.LCP) is an internal binary format used by FlamMap to store all input data layers. The FRAS application automatically creates the FlamMap format LCP file using GIS data stored within ArcView as GRID files. This process is transparent to the user.

themes in the FRAS AOI View after the WFSI calculations are completed in ArcView.

#### *Weather Influence Zones versus Districts*

A WIZ is defined as an area of relative homogenous weather patterns. FlamMap is run per Weather Influence Zone rather than per District. FRAS operates on a Florida DoF District basis. Accordingly, if a District is to be remodeled using FlamMap, then all of the Weather Influence Zones must be run separately within FlamMap, and then joined together to facilitate further FRAS processing.

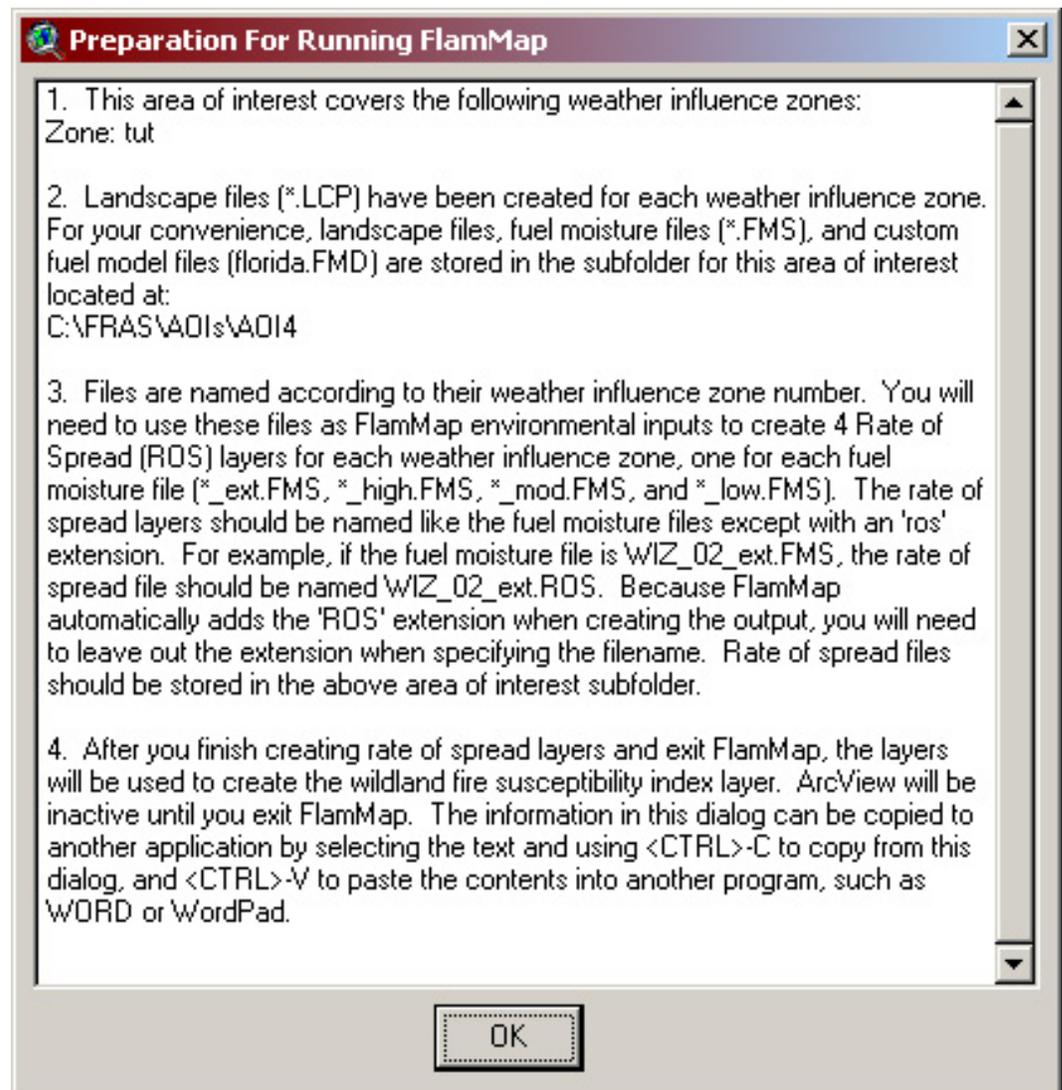
Accordingly, FlamMap must be run four times (once for each weather category – low, moderate, high and extreme) for each WIZ within the AOI selected. All four runs can be done during one FlamMap session. Table 1 presents the Weather Influence Zones (WIZ) found in each DoF District.

**Table 1: Weather Influence Zones per District.**

<b>District</b>	<b>Weather Influence Zones</b>
01 - Blackwater	1, 2
02 - Chipola River	1, 2, 3, 4
04 - Tallahassee	3, 4
05 - Perry	5, 6
06 - Suwannee	6, 7
07 - Jacksonville	7, 8
08 - Waccasassa	5, 7
10 - Bunnell	8, 10, 11
11 - Withlacoochee	9, 10
12 - Orlando	10, 11

District	Weather Influence Zones
14 - Lakeland	12, 13
15 - Myakka River	12, 13, 15
16 - Okeechobee	13, 14, 16
17 - Caloosahatchee	15, 16
18 - Everglades	17, 18, 19, 20

To re-calculate WFSI and start FlamMap, select the **Create WFSI (FlamMap)** option from the **FRAS Modeling** menu. FRAS will convert the required GRIDs for the active AOI Data View, generate a landscape file for use with FlamMap, and lists a description of the steps required before starting FlamMap. The **Preparation for Running FlamMap** dialog is presented in [Figure 57](#).

**Figure 57: Preparation for Running FlamMap Dialog**

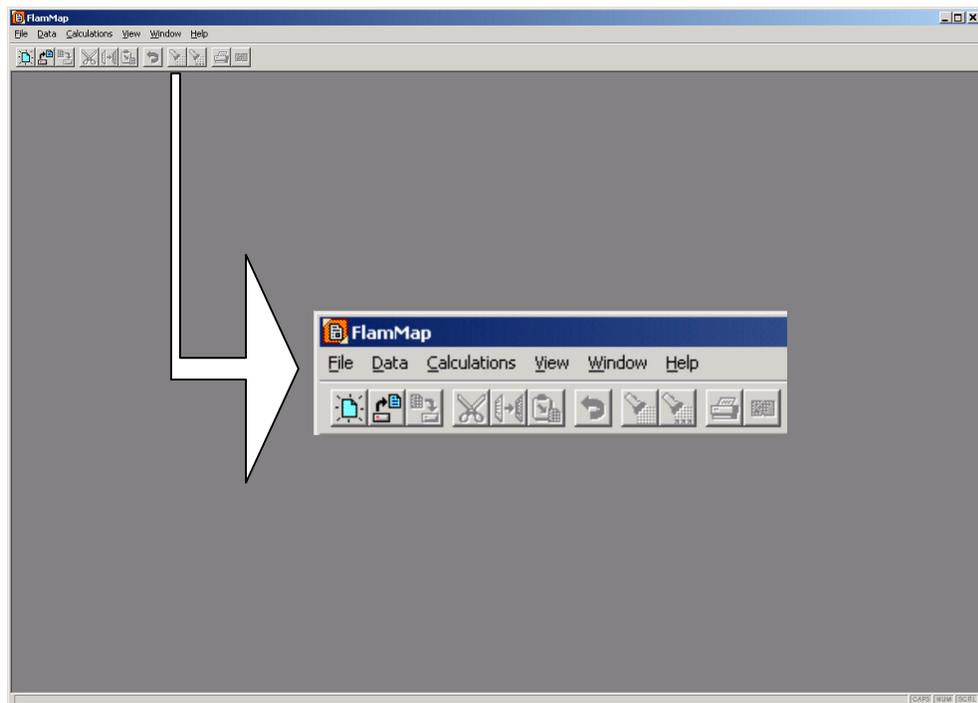
The report dialog provides important information that you need to know prior to running FlamMap. This information includes:

- The list of the weather influence zones (WIZ) within your AOI,
- The location of the \*.LCP and \*.FMS files, and
- Naming conventions for output FlamMap ROS files.

Press **OK** to dismiss the dialog and start the FlamMap program interface.

When FlamMap starts you will be presented with a blank interface as shown in [Figure 58](#). Note that the pull-down menu options are enlarged for presentation.

**Figure 58: The Default FlamMap Interface**



The next series of steps defines the menu selections required within the FlamMap program to recreate the Rate of Spread output data layer for all the weather scenarios, for all the WIZs, within your AOI.

**Step 3: Defining Environmental Inputs**

The environmental inputs for the FlamMap run must be specified per weather category per weather influence zone. Currently, this includes selection of:

1. a landscape file,
2. fuel moisture file (defined as either Low, Moderate, High or Extreme),
3. custom fuel model file, and
4. the 20' wind speed.

The landscape file is selected during this step and can be used for all FMS files for a WIZ. Accordingly, you do not need to reselect the landscape file with each FMS category selection. Note that the FlamMap menu option **File-Load FARSITE LCP File** will also prompt you with the Environmental Inputs dialog for defining the landscape file.

These fuel moisture files represent corporate data and must not be changed by the user.

The fuel moisture file is a text file that defines values for a specific range, such as Low, Moderate, High or Extreme conditions. The file has an .FMS extension. Four files have been predefined and are provided for each WIZ. These files are copied to the AOI folder automatically and the directory provided in the Preparation for Running FlamMap report that opens prior to FlamMap opening. [Figure 59](#) presents an example of the FMS file format for the WIZ Extreme file.

A standard file naming convention has been employed for the files:

WIZ\_##\_<code>.FMS

Where:

## is the WIZ number

<code> is low, mod, high, or ext.

For example: WIZ\_01\_Ext. FMS

In order from left to right, the columns represent the following fields:

- FBPS fuel model,
- 1 Hour Fuel Moisture,
- 10 Hour Fuel Moisture,
- 100 Hour Fuel Moisture,
- Herbaceous Fuel Moisture, and
- Woody Fuel Moisture.

Consult the FlamMap help file for a complete explanation of the FMS field definitions.

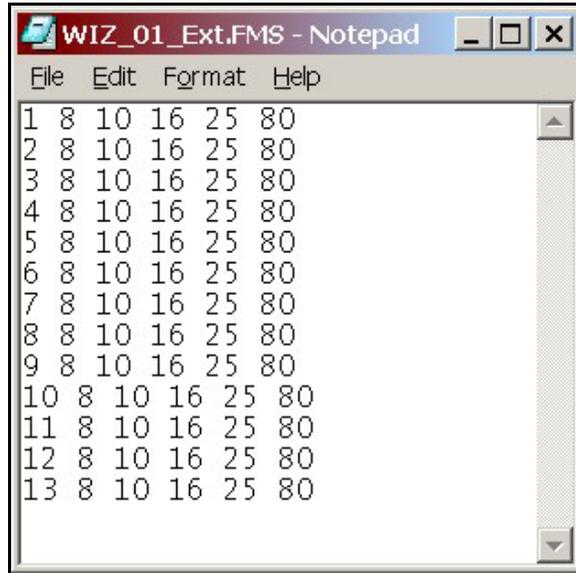
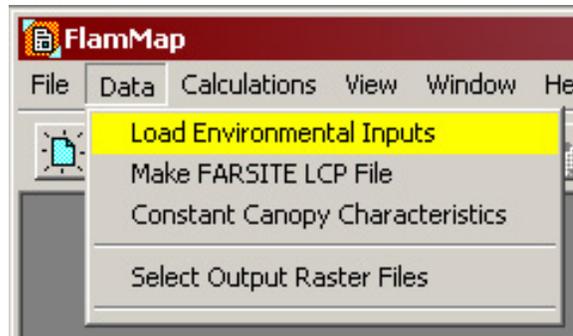
**Figure 59: Example FMS File (Extreme)**

Figure 60 presents the FlamMap dialog for defining the environmental inputs. To define the environmental inputs follow these steps:

1. Choose **Data – Load Environmental Inputs** from the FlamMap menu options.



2. Check the **Landscape File (.LCP)** checkbox and navigate to and select the LCP file provided from FRAS created during the previous step. Figure 60 presents the dialog that will appear. A standard file browser will appear to support this definition. Note that the **File-Load FARSITE LCP File** menu option will also present you with the same dialog for this step.

Figure 60: FlamMap – Define Environmental Inputs Dialog

The dialog box, titled "Environmental Inputs", contains the following settings:

- Landscape File (.LCP)
- Fuel Moisture File (\*.FMS)
- Custom Fuel File (\*.FMD)
- Fixed Fuel Moistures from .FMS

---

Wind settings:

- Wind Blowing Uphill    Speed (MPH) 20ft
- Wind Direction    Azimuth Degrees

---

Weather and Wind files:

- Weather File (.WTR)
- Wind File (.WND)

Fuel Moisture Conditioning Period:

Month   to..

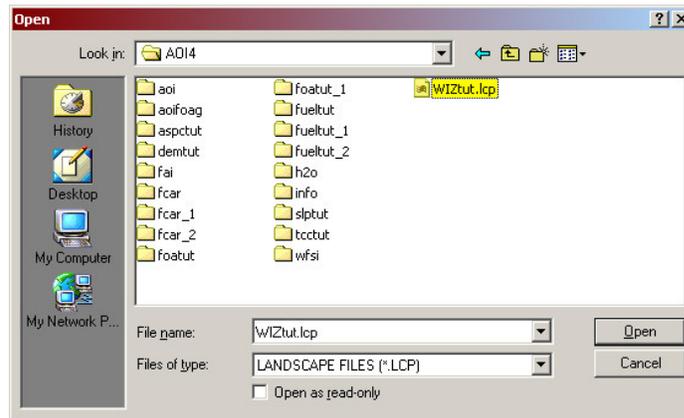
Day   to..

Hour   to..

Buttons: OK, Cancel, Help

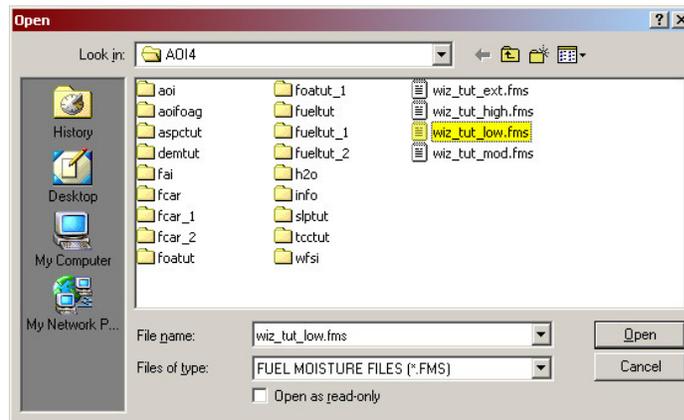
Figure 61 presents the dialog to define the LCP file. Note that you will need to navigate to the specific AOI folder for your AOI Data View. The .LCP file is automatically created and placed there by the FRAS ArcView application prior to starting FlamMap.

Figure 61: FlamMap – Select LCP File Dialog



3. Check **Fuel Moisture file (\*FMS)** and locate the data file. Figure 62 presents the FMS file selection dialog. Navigate to the appropriate AOI subdirectory, and select either the Low, Moderate, High or Extreme data file. Each FMS is automatically created in the AOI folder for the active AOI Data View.

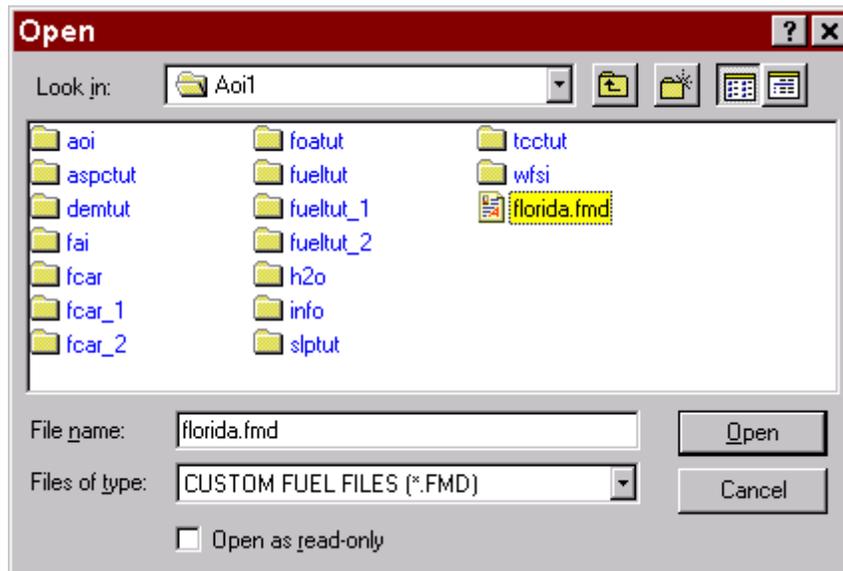
Figure 62: FlamMap – Select FMS File Dialog



Note this is a step you will need to do for each run of an FMS weather scenario. For example (for WIZ 1) the files would be WIZ\_01\_Low.FMS, WIZ\_01\_Mod.FMS, WIZ\_01\_High.FMS, or WIZ\_01\_Ext.FMS.

4. Check **Custom Fuel File (\*FMD)** and locate the florida.fmd data file. [Figure 63](#) presents the FMD file selection dialog. Navigate to the appropriate AOI subdirectory, and select the data file. The FMD is automatically copied to the AOI folder for the active AOI Data View.

**Figure 63: FlamMap – Select FMD File Dialog**



5. Check on **Wind Blowing Uphill** option and change the **Speed (MPH) 20ft** value to the appropriate value for the fuel moisture category, i.e. Low, Mod, High or Ext for the WIZ (see [Figure 60](#)). [Table 2](#) defines the 20-foot wind speed values for each category for each WIZ. Use the values from this table to define the appropriate value in the FlamMap dialog.

The dialog accepts 20' wind speed numbers as decimals but then appears to round them down to the nearest whole number. FlamMap does use the decimal number and therefore the decimal number must be entered.

Table 2. Wind Speed Values for WIZs

WIZ	20' Wind Speed			
	Extreme	High	Moderate	Low
<b>1</b>	14.7	11.6	5.6	4
<b>2</b>	15.1	11.2	7.2	5.4
<b>3</b>	14.2	10.1	6.6	3.3
<b>4</b>	14.1	10.2	6.3	3.1
<b>5</b>	14.3	10	6.2	3.3
<b>6</b>	14.2	9.9	6.3	3.3
<b>7</b>	14.8	9.8	6.9	4.8
<b>8</b>	16.6	11.6	6.4	4.3
<b>9</b>	16.9	11	8	4.8
<b>10</b>	17.4	11.4	7	4.7
<b>11</b>	17.2	11	7	4.6
<b>12</b>	16.3	11.1	7.9	4.7
<b>13</b>	17.7	12.3	8.2	4.9
<b>14</b>	17.1	12.5	9.1	5.7
<b>15</b>	15	11.2	7.2	3.7
<b>16</b>	16.7	12.3	9.2	5.1
<b>17</b>	19.2	13.3	10	5.4
<b>18</b>	19.6	14.2	9.6	5.3
<b>19</b>	20	14	9.1	5.1
<b>20</b>	22.2	15.6	10.4	5.1
<b>Tutorial</b>	16.6	11.6	6.4	4.3

6. Press **OK** to complete the definition and exit the dialog. FlamMap has now saved these values.

#### Step 4: Defining the Output Data Specifications

Once the environmental characteristics are defined, the output data specifications must be defined. Select **Data, Output Specifications** and the dialog shown in [Figure 64](#) will appear.

Figure 64: FlamMap - Output Raster Data Dialog

**Outputs from Fire Calculations** [X]

Relative Spread Direction From Maximum Degrees

Absolute Spread Direction Azimuth [0]

---

Fireline Intensity (FLI) (kW/m)

Spread Rate (ROS) (m/m)

Flame Length (FML) (m)

Heat/Unit Area (HPA) (kJ/m<sup>2</sup>)

Crown Fire Activity (CFR) (0-3)

Midflame Windspeed (mph)

---

Horizontal Movement Rate (RHM) (m/min)

---

Solar Irradiance (SLR) (cal/cm<sup>2</sup>/min)

1hr Fuel Moisture (FMO) (%)

10hr Fuel Moisture (FMT) (%)

---

Max Spread Direction

Elliptical Dimension 'a'

Elliptical Dimension 'b'

Elliptical Dimension 'c'

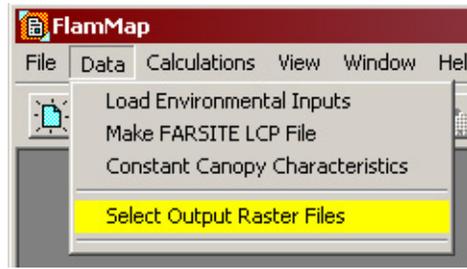
OK

Cancel

Help

To define the output data specifications follow these steps:

1. Choose **Data – Select Output Raster Files** from the FlamMap menu options.



2. Select **Spread Rate (ROS)**. You will be prompted to define the output ROS file name. [Figure 65](#) presents this dialog. The naming convention must follow the same format as that of the FMS files, namely 'WIZ\_##\_Code.ROS', for example:

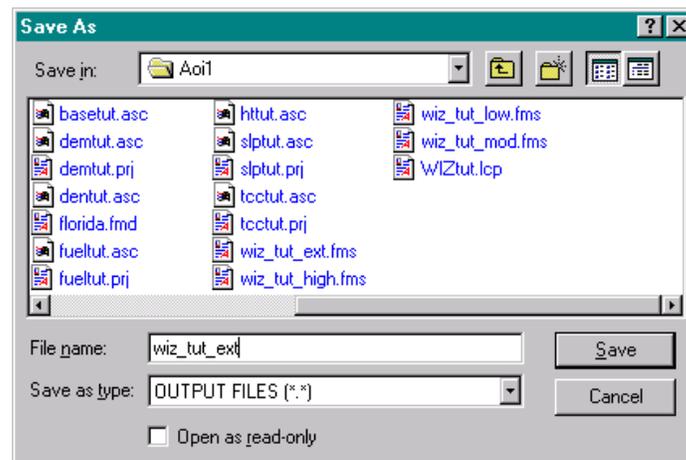
Wiz\_01\_ext.ROS,

Wiz\_01\_high.ROS,

Wiz\_01\_mod.ROS, or

Wiz\_01\_low.ROS

**Figure 65: FlamMap – Defining the ROS File Name**



Note that the ROS extension is automatically added in FlamMap. Therefore the name entered in the dialog box must not contain the ROS. The example in [Figure 65](#) shows the ROS file generated using the Tutorial data set (wiz\_tut\_ext).

3. Press **Save** to complete the definition and exit the dialog. FlamMap has now saved the ROS output file name.

### **Step 5: Generating ROS Output**

Once the output data specifications are defined, FlamMap can recreate the Rate of Spread (ROS) output data file. Follow these steps:

Choose **Calculations – Run** from the FlamMap menu options. An informational message will be presented that shows % completed.



Once the ROS data file has been successfully completed, the program displays the message shown in [Figure 66](#).

**Figure 66: FlamMap - ROS Completion Message**



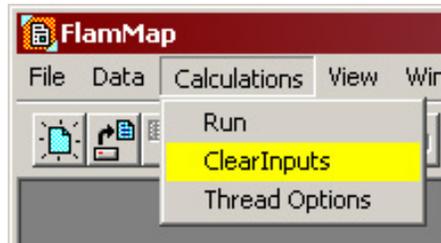
Once the ROS file for a single weather category (i.e. low, mod, high or ext) for the WIZ has been created, the following steps need to occur:

### **Step 6: Clearing Inputs and Creating the Next Percentile Weather ROS File**

Since four ROS files for each WIZ are needed, proceed to the next weather category. Follow these steps:

1. Follow steps 3 through 5 to create the ROS file. For the same WIZ you do not need to change the LCP file selection or the custom fuel model selection in Steps 4 and 5. However, you do need to redefine the FMS file for the appropriate category (i.e. low, moderate, high or extreme). The same LCP file can be used for all categories within the WIZ. To change the FMS file in Step 3, uncheck the box next to **Fuel Moisture file (\*FMS)** and recheck it. A dialog will open to prompt for the selection of the new FMS file.

You can also use the **Calculations – Clear Inputs** menu option and then start again with the **Data – Environmental Inputs** definition ([step 3](#)). If you choose this method you will need to reload the LCP file.



2. Once all four ROS files have been created, proceed with the next WIZ if more than a single WIZ exists for the AOI selected. If more than one WIZ is required, redefine a new LCP file (for the new WIZ) in Step 5.

### **Step 7: Exiting FlamMap and Creating WFSI**

Once all ROS categories have been created for all WIZs in the District, FlamMap must be closed by selecting the **File – Exit** menu option (or pressing the [X] in the top right of the FlamMap window). When prompted to confirm the exit, select the **Yes** button. ArcView will not be active until FlamMap has been closed.

Exiting FlamMap will initiate a process within FRAS that automatically converts the output ROS ASCII files into ArcView GRID format. This conversion will occur transparent to the user except for the processing messages in the center of the screen and at the bottom of the ArcView window. FRAS will first check to ensure that all four ROS files exist for each WIZ. If a file is missing, a message will appear and it will be necessary to run FlamMap again to create these files. If all files have been successfully created, the dialog in [Figure 67](#) will be presented.

**Figure 67: FlamMap - ROS Confirmation Message**



Pressing **OK** will initiate the conversion process. Once the file conversion is completed, the ROS values are converted from meters/minute to chains/hour, the final fire size is calculated, and WFSI values are calculated per weather category. The grids are named according to the following convention WIZ##\_Code and are not added to the view, however Rate of Spread and Final Fire Size maps can be created using the **Create Maps** option of the **FRAS Outputs** menu.

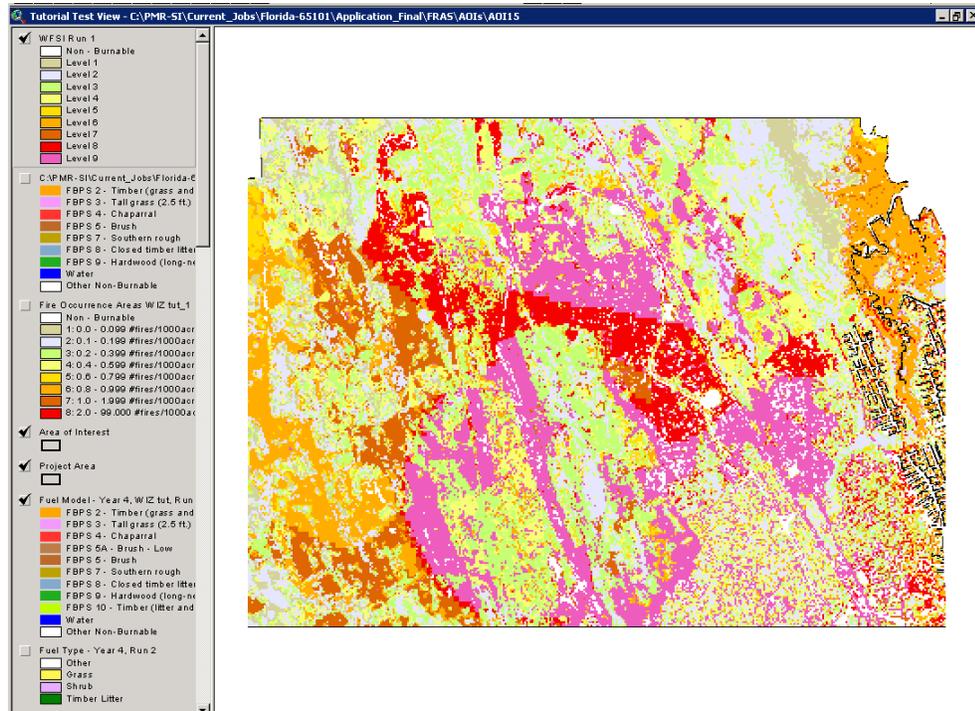
The final WFSI for the WIZ is then calculated by summing the four weather category WFSI values. Depending on the size of the AOI, the conversion of the ROS grids and the calculation of the WFSI can take some time. Upon completion of the WFSI calculations, the dialog in [Figure 68](#) will appear.

**Figure 68: FlamMap – WFSI Completion Message**



The final WFSI grid is then added to the FRAS AOI View. [Figure 69](#) presents an example of this new theme added to the AOI Data View.

**Figure 69: FlamMap – Updated WFSI Added to the AOI Data View**



## Deriving Levels of Concern (LOC)

The primary output of the risk assessment process is the Levels of Concern (LOC) map. You can recalculate a new LOC dataset by using the **Create Levels of Concern** option on the **FRAS Modeling** menu.

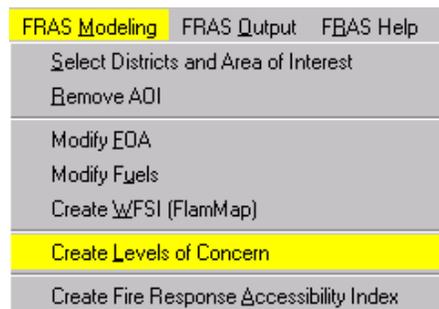
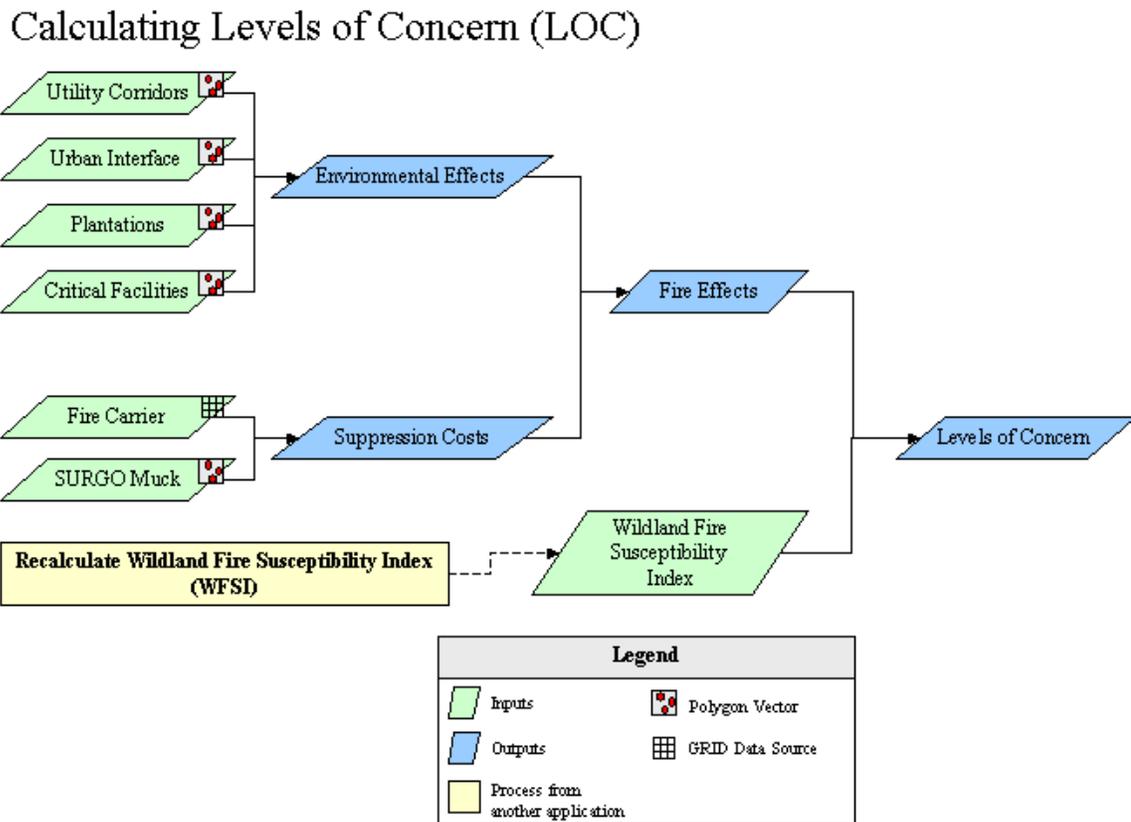


Figure 70 presents a data flow of the LOC calculation process. LOC can be changed if:

- WFSI is changed,
  - FOA changes,
  - Fuel models change,
- Different Environmental Effects or Suppression Costs scores are assigned.

**Figure 70: The LOC Data Flow**



Also, FRAS will allow the user to change the scores for each of the LOC model inputs through adjusting the score in the Score Dialog Box. In addition, you can determine which layers should be included in the LOC analysis by turning the layer on or off using the checkbox at the left of the data layer name. [Figure 71](#) presents the dialog for the LOC model for users with Spatial Analyst.

**Figure 71: The LOC Dialog Box for Users with Spatial Analyst**

Is Data Layer Included?	Theme Name	Score	Adjust Score?
<input checked="" type="checkbox"/>	Critical Facilities	33	<input type="button" value="Adjust"/>
<input checked="" type="checkbox"/>	Plantations	31	<input type="button" value="Adjust"/>
<input checked="" type="checkbox"/>	Utility Corridors	27	<input type="button" value="Adjust"/>
<input checked="" type="checkbox"/>	Urban Interface	37	<input type="button" value="Adjust"/>

Suppression Costs

Fuel Type: fcar

Base Costs: 32

Grass Costs: 9

Shrub Costs: 33

Timber Litter Costs: 40

SURGO Muck Soils: 60

Wildland Fire Susceptibility Index

If the coverage or data layer is not available for the Area of Interest, the layer cannot be turned on. At any time, the user can reset the original default scores by clicking on the **Reset Default Scores** button.

If the user has Spatial Analyst, FRAS allows the user to update two of the inputs into **Create Levels of Concern**, namely

- Fuel Type and
- Wildland Fire Susceptibility Index.

If one of these inputs has changed, the user will be prompted to select one of a list, as with the **Select Wildland Fire Susceptibility Index** section of the dialog box in [Figure 71](#). If the user hasn't specified which layer should be used, a **Missing Data Layer(s)** dialog opens listing the files that need to be designated. [Figure 72](#) is an example of the missing files dialog box.

**Figure 72: LOC - Missing Data Layer(s) Dialog Box**

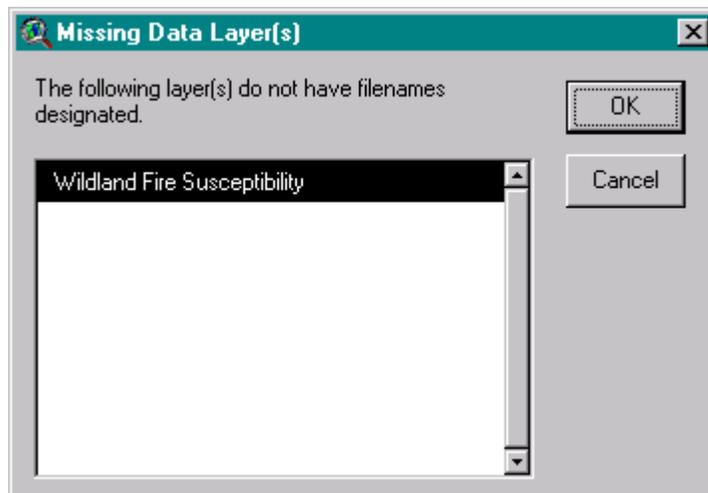


Figure 73 presents the LOC Dialog Box for users **without** Spatial Analyst. The most marked differences are the lack of Fire Response Accessibility Index and Select Wildland Fire Susceptibility Index. This is due to the fact that users who do not possess spatial analyst will not be able to update these inputs. Therefore the coverages used as inputs will always be the Published Results.

**Figure 73: The Levels of Concern Dialog Box for Users without Spatial Analyst**

Is Data Layer Included?	Theme Name	Score	Adjust Score?
<input type="checkbox"/>	Critical Facilities	33	
<input checked="" type="checkbox"/>	Plantations	31	
<input checked="" type="checkbox"/>	Utility Corridors	27	
<input type="checkbox"/>	Urban Interface	37	

Fuel Type	Score	Adjust Score?
Base Costs	32	
Grass Costs	9	
Shrub Costs	33	
Timber Litter Costs	40	
<input type="checkbox"/> SURGO Muck Soils	60	

Reset Default Scores

Create Cancel Help

Once all parameters and weightings are defined press the **Create** button to recreate the LOC data. The **Cancel** button can be clicked any time prior to clicking the Create button to cancel the tool.

### Adjusting Scores

The score dialog is opened by clicking on the icon to the right of the Create Levels of Concern dialog, next to each data layer. [Figure 74](#) shows a picture of the icon that is to be selected in order to change the score.

**Figure 74: LOC - The Adjust Score Dialog Box Button**



[Figure 75](#) presents the score dialog box. The score dialog box allows the user to adjust the weightings applied to each data layer. A score of 1 to 4 is assigned per cell in the matrix based on what the effects will be given the flame length and fire size. There are four fire size categories: 0-9, 10-99, 100-999, and 1000+. There are three flame length categories: 0-4, 5-8, and 8+. Each combination of the two parameters is looked at independently and scored based on the effect for that data layer where 1 is low effect and 4 is high effect. The highest total possible score if all 12 cells in the matrix are assigned a 4 would be 48 whereas the lowest possible score would be a 12.

**Figure 75: LOC - The Adjust Score Dialog Box**

		Fire Size (Acres)			
		0 - 9	10 - 99	100 - 999	1000 +
Flame Length (Feet)	0 - 4	1	2	2	3
	5 - 8	1	3	4	4
	8 +	2	3	4	4
Total Score:		33			

<< Apply Score >>    Cancel    Help

The user selects from a pull down list a number between 1 and 4 to represent the effects the fire size and flame length would have on that

data layer. The total score is automatically calculated after every change is made. To save the scores press the **Apply Score** button. Press **Cancel** to dismiss the dialog without saving the changes.

Figure 75 presents an example of the Critical Facilities default weights. To change values, the user selects the arrow down next to the value to be changed. A drop down list showing the numbers between 1 and 4 appears. The user then would select a new number, which then re-totals the Total Score field.

### ***Levels of Concern Output***

There are four outputs to the Levels of Concern function:

- i. Environmental Effects = (A\*Critical Facilities) + (B\*Plantations) + (C\*Utility Corridors) + (D\*Urban Interface); where A-D are weightings generated from the scores
- ii. Suppression Costs = Muck weight if muck is present, else equals Fuel Type weight
- iii. Fire Effects = Environmental Effects + Suppression Costs
- iv. Levels of Concern = Fire Effects \* WFSI



Unlike the other modeling tools provided, the LOC can be calculated if the user does not have the ArcView Spatial Analyst software. Since the LOC is comprised of weightings from different input layers it can be calculated on a polygon data set (rather than a raster data set). Accordingly, a table modeling function was included to support those non-Spatial Analyst users in recalculating the final output, LOC, if required. Processing without Spatial Analyst typically takes much longer due to the use of a table modeling approach. However, this is fully dependent on the size of the AOI.

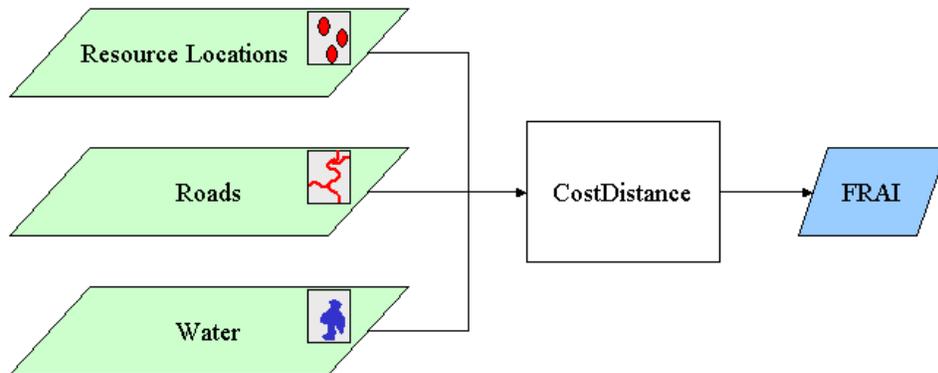
The output from the Levels of Concern function is generally the same regardless of whether or not the user has Spatial Analyst (i.e. whether table modeling (polygon) or raster modeling (grids) is employed). The biggest differences between the data sets can only be seen once you are zoomed into small areas.

### **Deriving the Fire Response Accessibility Index (FRAI)**

The Fire Response Accessibility Index allows users to classify areas based on accessibility by their fire suppression resources. Coupled with the Levels of Concern data, this information will highlight areas where accessibility and the level of concern have combinations that are not desirable.

This function allows the user to input new resource locations, road information, or change the ratio of rate of travel on the road vs. rate of travel off the road. The program utilizes the *costdistance* raster processing function of ArcView's Spatial Analyst module. This function allows for cell value allocations based on a minimum time distance from a resource location using the estimated time it would take to travel through each cell.<sup>6</sup> Figure 78 presents a flowchart of the FRAI data processing.

**Figure 78: FRAI Data Flow**



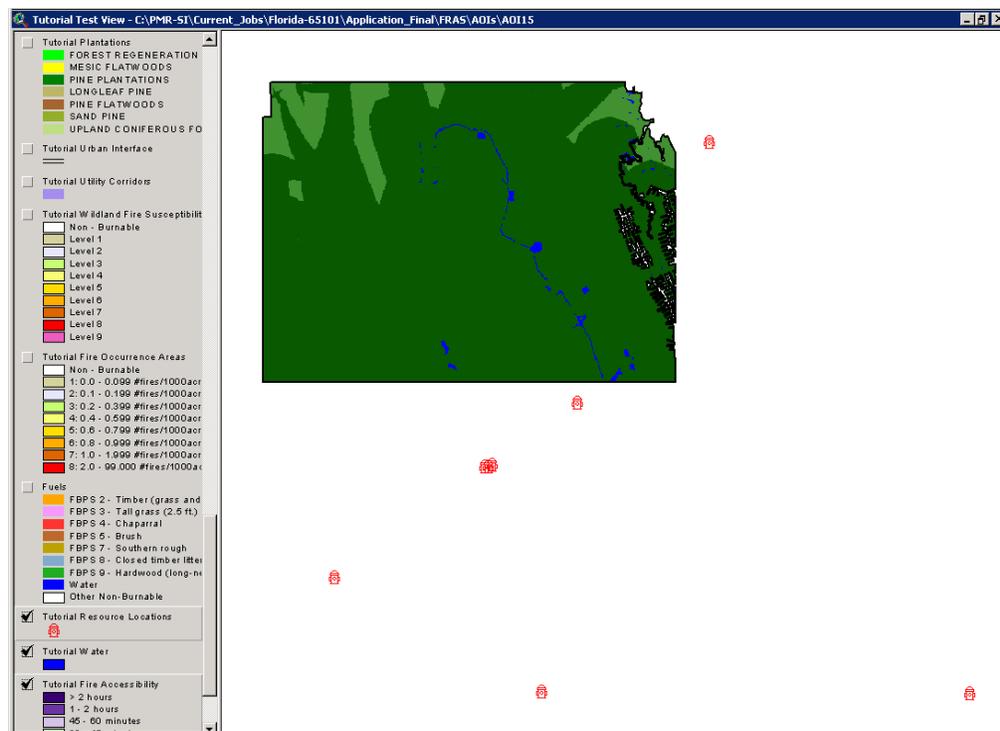
The FRAI model uses the input Resource Locations as the *source* grid and the cost grid is developed using the relative time it takes to travel on a road versus a non-road overlaid with water, where time travel is infinite (assuming that resources cannot travel through water). The Resource Locations are converted to a grid where the locations have a value of 1 and the remaining points have a no-data value. The roads are converted to a grid whereas the value entered under '**Estimate how many times faster a road is than a non-road**' is used to populate the value where roads exist and a value of 1 is assigned to every other cell, with the exception of areas covered with water which are assigned a value of 'NO DATA'.<sup>7</sup>

<sup>6</sup> The Spatial Analyst software provides raster-processing functions that have been utilized for most modeling capabilities found within the FRAS application.

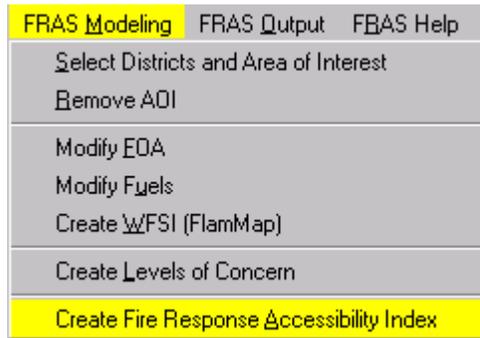
<sup>7</sup> The term NO DATA is used to represent areas on the map where information does not exist (i.e. where there are no resource locations) and hence, no processing is undertaken for these areas.

If the resources and roads data layers are clipped to the boundary file, the FRAI model will interpret the edges to be less accessible than the center whereas that may not be the case. Therefore, resources and roads extend 8-miles outside the Area of Interest. See [Figure 79](#) presents an example of how resources outside the AOI still impact the accessibility within the AOI.

**Figure 79: Example Of How Resources Outside an AOI Can Impact Accessibility**

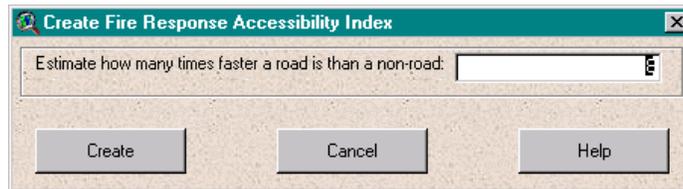


Select the Create Fire Response Accessibility Index option from the FRAS Modeling menu.



The interface dialog for FRAI has been developed to be interactive with the user based on modifications that may, or may not, have previously occurred with the Resource Locations data (see [Updating Resource Locations](#)) and updates to roads. [Figure 80](#) presents the dialog that will appear if no changes to the Resource Locations have occurred.

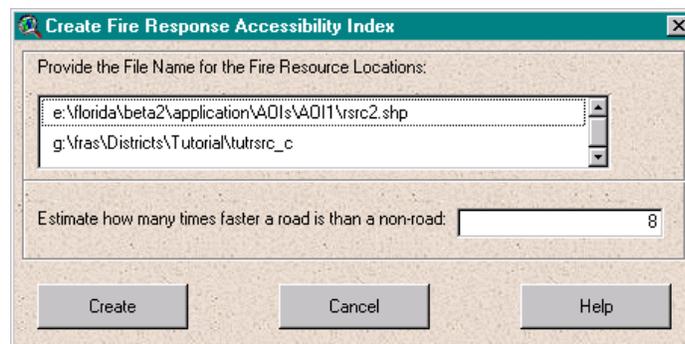
**Figure 80: FRAI Dialog – No Resource Location Updates**



The **Cancel** button can be clicked any time prior to pressing the **Create** button to cancel the FRAI model.

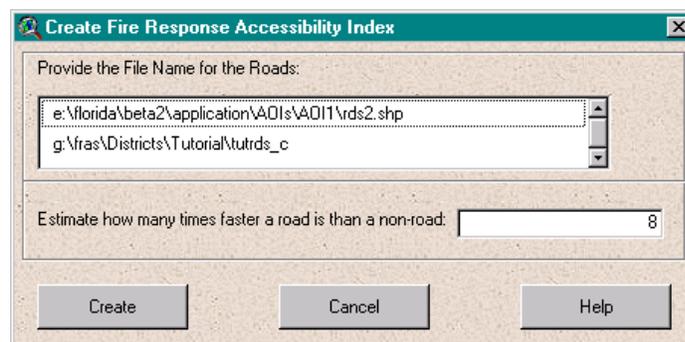
If the Resource Locations were updated the dialog would appear as shown in [Figure 81](#). Note that all file naming requirements as defined in the [Updating Resource Locations](#) section must be adhered to for this model to utilize the updated data (i.e. **rsrc** naming convention). The program looks for the point locations. The attributes associated with the points do not affect the modeling procedure.

**Figure 81: FRAI Dialog – For Updated Resource Locations**



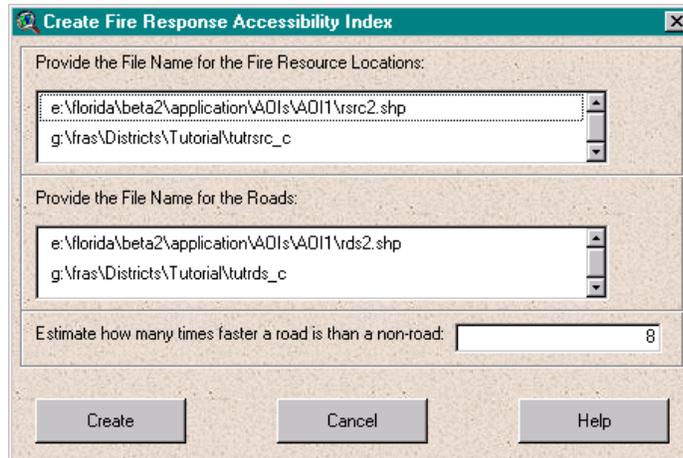
In addition, if the roads data has been updated and saved in the specific AOI folder (and named according to the '**rds**' naming convention (i.e. rds2, rds3, etc.)), the dialog would appear as in [Figure 82](#). The program looks for the line locations. The attributes associated with the roads do not affect the modeling procedure.

**Figure 82: FRAI Dialog – For Updated Roads Data**



If both the resources and the roads were updated, the user would be allowed to choose from a list for both data layers, as shown in [Figure 83](#).

**Figure 83: FRAI Dialog – Both Resource Locations and Roads Updated**



In the dialogs shown in **Figures 81-83** you must select the data you wish to use to calculate the new FRAI. This can be the updated data or the Published Results data for the District from which your AOI has been defined. In most cases, the user will want to use the updated data if it exists. The examples presented above use the Tutorial data set as the default District. Select the data file in each scroll list that is presented. As in [Figure 80](#), no updates have been undertaken, therefore the Published Data for the District AOI will be used.

### ***Estimating How Many Times Faster A Road Is Than A Non-Road***

All dialogs require that you estimate how many times faster a road is than a non-road for accessibility. This is a general estimate of how much faster travel on road is than travel off road. For instance, if general road travel were 40 mph whereas general off-road travel is about 5 mph, then the value that would be entered here would be  $40 / 5 = 8$  (which is the default value).

Press the **Create** button to re-calculate the FRAI using the parameters specified in the dialog box. The output data is saved to the AOI directory and is titled using **FAI##** notation where **##** represents a sequential numbering for the new FRAI output.

## VII. Generating Output Maps and Reports

Tools are provided to generate maps and reports for the Published Results and AOI data. The same suite of tools can be used on either data view(s). This section describes how to create maps and reports for the output data.

### Standard Maps

A series of standard maps are provided in FRAS. Here, users can generate maps quickly and easily using either Published Results data or newly created custom AOI data. Depending on which view is open, the user can also print maps of the specific AOI or for all the Districts available on disk in the FRAS directory.

#### ***Step 1: Opening the Standard FRAS Map Dialog***

Select an active view. This can be either the Published Results View or an AOI Data View. Select the **Create Maps** option from the **FRAS Output** menu.

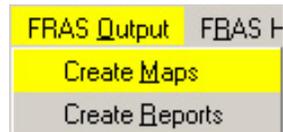
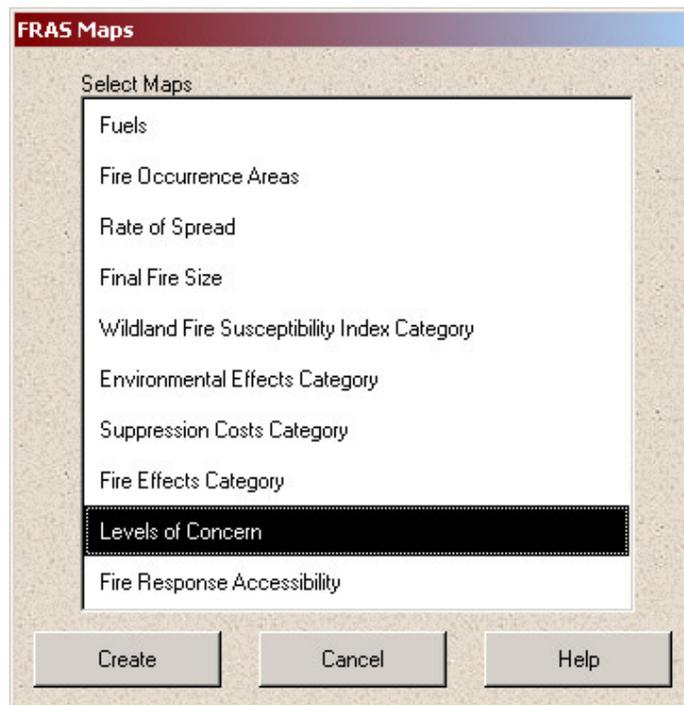


Figure 84 presents the map dialog.

**Figure 84: Create Maps Dialog**



**Step 2: Selecting Which Map to Create**

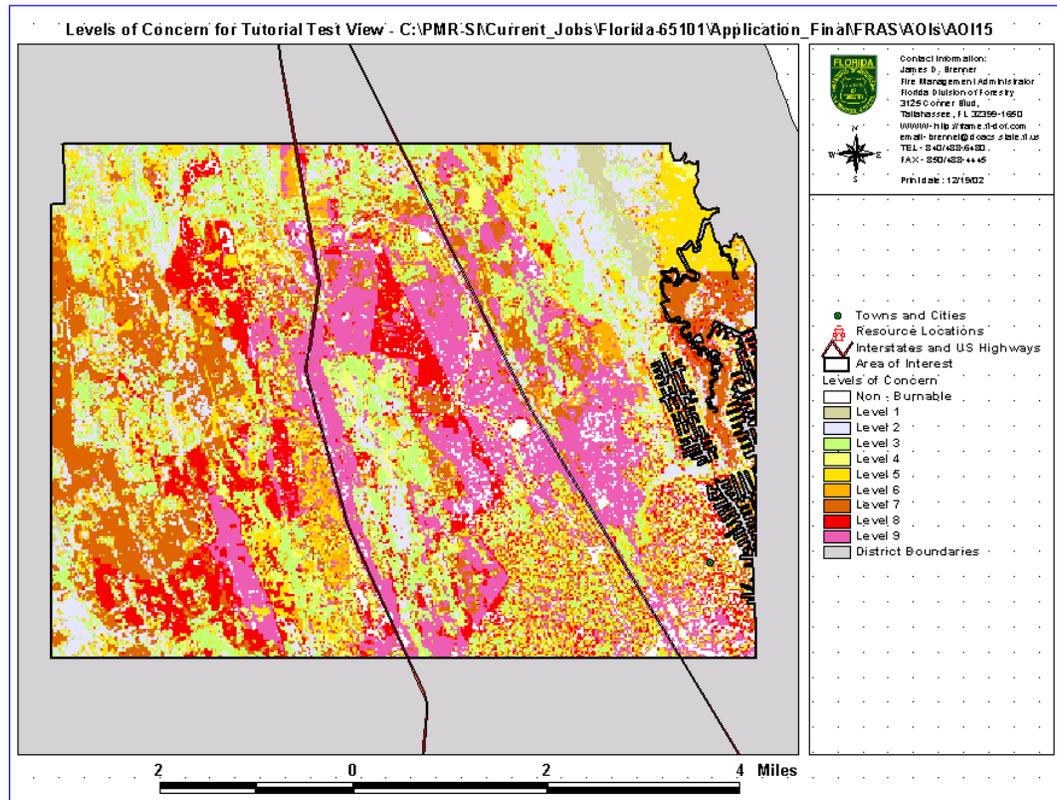
There are 10 standard maps provided with FRAS:

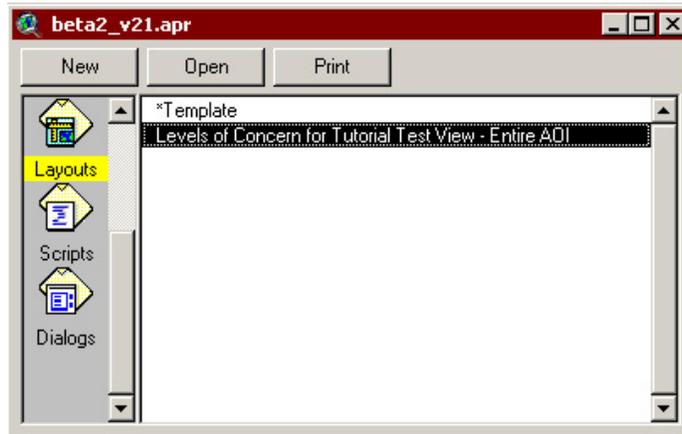
- Fuels
- Fire Occurrence Areas
- Rate of Spread (can choose between low, moderate, high or extreme weather categories)
- Final Fire Size
- Wildland Fire Susceptibility Index Category
- Environmental Effects Category

- Suppression Costs Category
- Fire Effects Category
- Levels of Concern
- Fire Response Accessibility

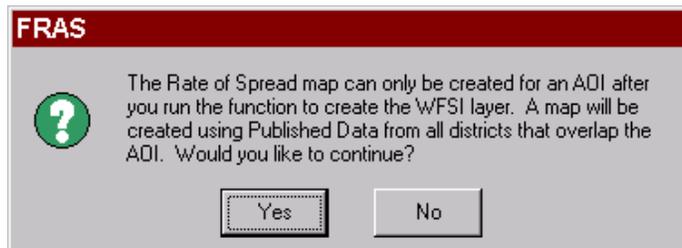
To create a map using one of these standard map layouts, highlight the map by clicking on the map title and click **Create**. FRAS then adds the relevant themes to the active view and generates the map using a predetermined layout as shown in [Figure 85](#). The selected map layout is automatically added to the Project Layouts list. To print the map, select the layout from the Layouts list and press the **Print** button. An example layout in the Layouts list is shown in [Figure 86](#).

**Figure 85: Create Maps - LOC Map Layout**



**Figure 86: Create Maps – Layout List Example**

If the user chooses to print a map but has not changed any of the data from the Published Results, FRAS will prompt the user as to whether or not the map should still be created ([Figure 87](#)). If so, then the map will be generated using the Published Results by clicking **Yes**, otherwise the user can opt to cancel the create map action by clicking No.

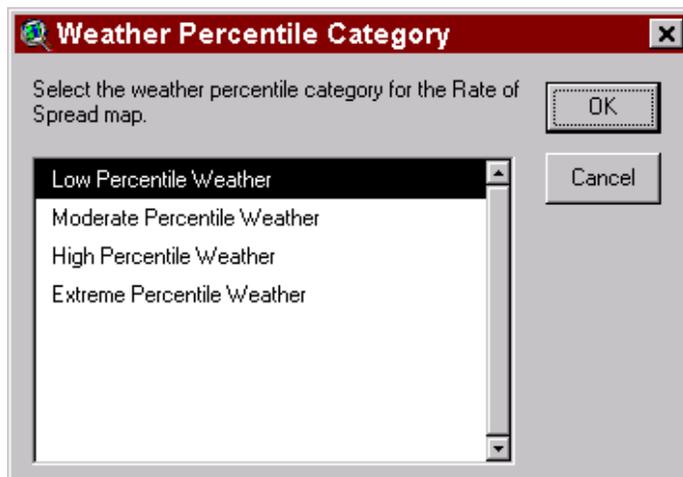
**Figure 87: Create Maps - Published Results Notification**

*List of Special Cases Where More Information is Required Before Map is Created*

### **Rate of Spread Weather Percentile Categories**

Rate of Spread values are calculated per weather category and are stored as such as attributes in the WIZ##\_Code grid, where ## represents the weather influence zone number, and the Code represents the weather category (i.e. low, moderate, high and extreme). The user must specify which weather category should be mapped. [Figure 88](#) shows the dialog that opens after the user selects one of these maps to create.

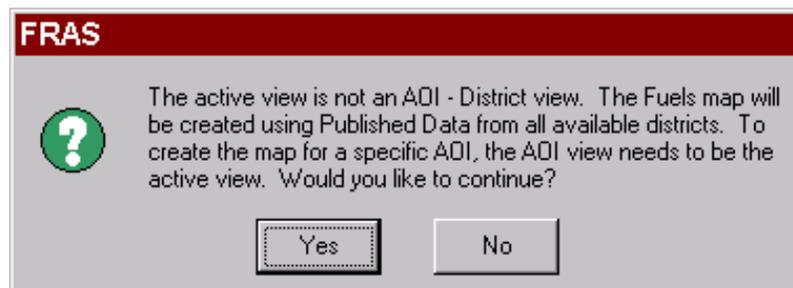
**Figure 88: Create Maps – Weather Category Selection Dialog**



### ***The Difference Between AOI and Published Results Maps***

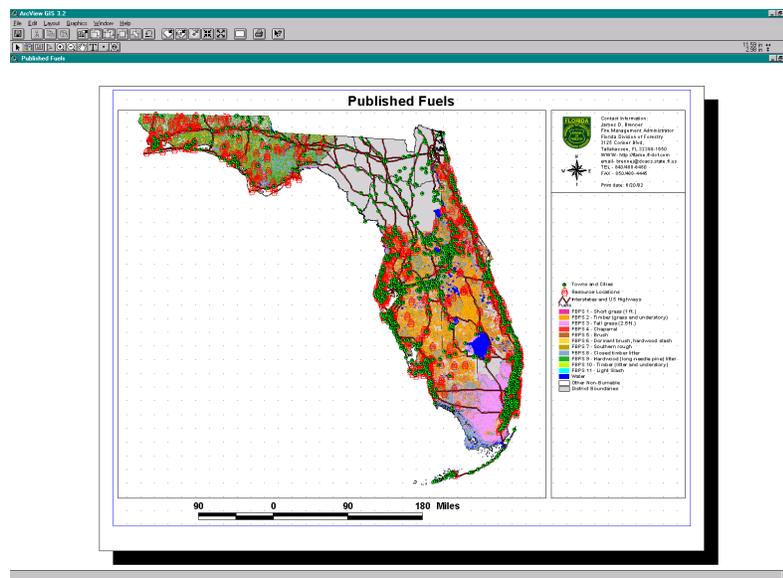
If the active view is the AOI view, then the maps generated will be for only that particular AOI. If the active view is anything else, then the maps generated will be generated for all available Districts in the FRAS directory. The user is prompted, in advance, so that the user can cancel the action. Creating a map for the entire state may take some time. This is presented in [Figure 89](#).

**Figure 89: Create Maps – Published Results Map Creation Confirmation Dialog**



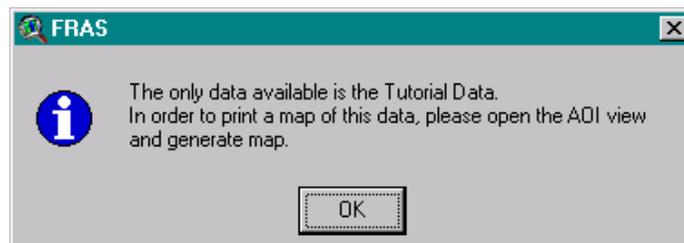
To generate a map using all available District data, the user would click **Yes**, and No to cancel the action. [Figure 90](#) shows an example of the Fuels map had the user selected 'Yes' and had Blackwater, Bunnell, Caloosahatchee, Chipola River, Everglades, Lakeland Myakka River, Okeechobee, Orlando, Tallahassee, and Withlacoochee data on disk in the FRAS directory.

**Figure 90: Create Maps – Multi-District Published Results Fuels Map Example**



The only exception is if the user only has the tutorial data loaded. Then the user will be prompted with a dialog to inform them that they only have the tutorial data and must create the map from the AOI View ([Figure 91](#)). This is done because maps created using all available Districts ignore the tutorial District folder since it overlaps with Bunnell.

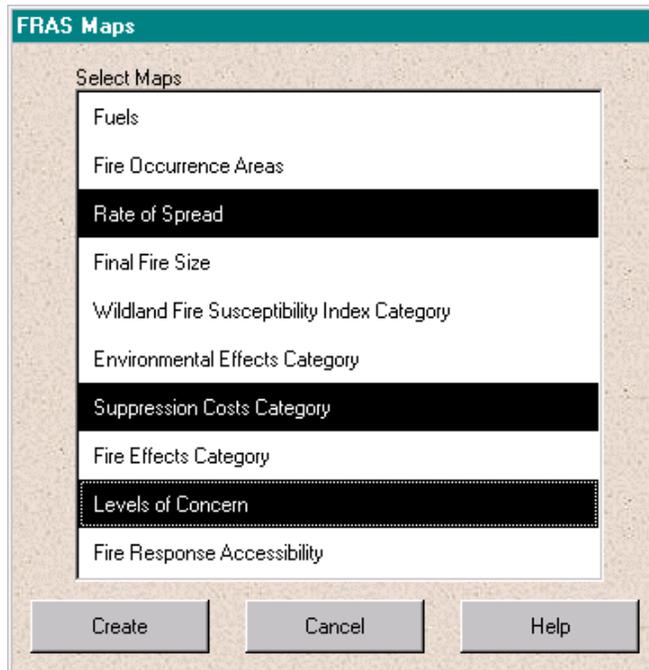
**Figure 91: Create Maps - Warning Message That Only Tutorial Data Exists**



### ***Creating Many Maps at Once***

Multiple maps can be created by clicking on the map titles while holding the SHIFT key. [Figure 92](#) presents an example.

**Figure 92: Create Maps - Selecting Multiple Maps To Create At Once**



***Creating a Map For Data that has Been Created Using Multiple Runs***

FRAS allows users to create and alter

- Fuel Models,
- Fire Occurrence Areas,
- Rate of Spread,
- Final Fire Size,
- Wildland Fire Susceptibility Index,
- Environmental Effects,
- Suppression Costs,
- Fire Effects,
- Levels of Concern, and
- Fire Response Accessibility Index.

Using the modeling capabilities, it is possible to create multiple grids within the same AOI Data View of the same theme, such as FOA, Fuels, WFSI. Each time one of these data sets is recreated, it is provided a sequential number referred to as the *model run*.

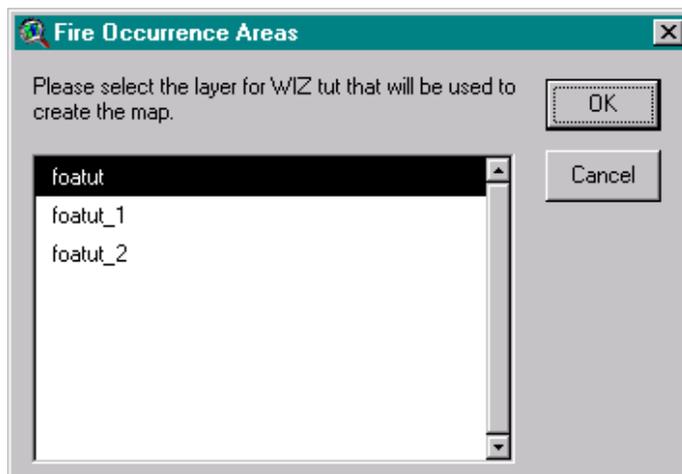
To distinguish between *model runs*, the theme is labeled with a '**Run #**' where **#** represents the run number. When the user selects a modeling function that will recreate a new output map (such as WFSI or LOC) using a newly created data layer, FRAS finds all instances of that data layer and prompts the user to specify which data layer should be used to generate the map.

The following example shows a WFSI theme that has been recreated using the modeling capabilities. The resulting output theme is added to the AOI data view, and tracked by FRAS using the unique run number (i.e. in this case 1).



The names listed in the prompting dialog have the naming convention **NAME\_#** where **#** represents the run number, equal to the run number of the themes and NAME is the name stored in the AOI directory. [Figure 93](#) presents an example show FOA data instances for an active AOI Data View that has been created using the Tutorial data set (i.e. note the "tut" suffix instead of a District code).

**Figure 93: Create Maps - Layer Selection Dialog When Multiple Versions of Data Exists**



If the title does not contain `\_#`, then it is the published data. The top item in the list, **foatut**, is the default coverage, the middle item, foatut\_1, is the first run of recreating or updating FOA and the last item, foatut\_2, is the second run of recreating FOA.

## Standard Reports

A series of standard reports are provided in FRAS. Here, users can generate reports using either Published Results or custom AOI data. The user can also generate reports of the specific AOI or for all the Districts regardless as to whether or not they are on disk.

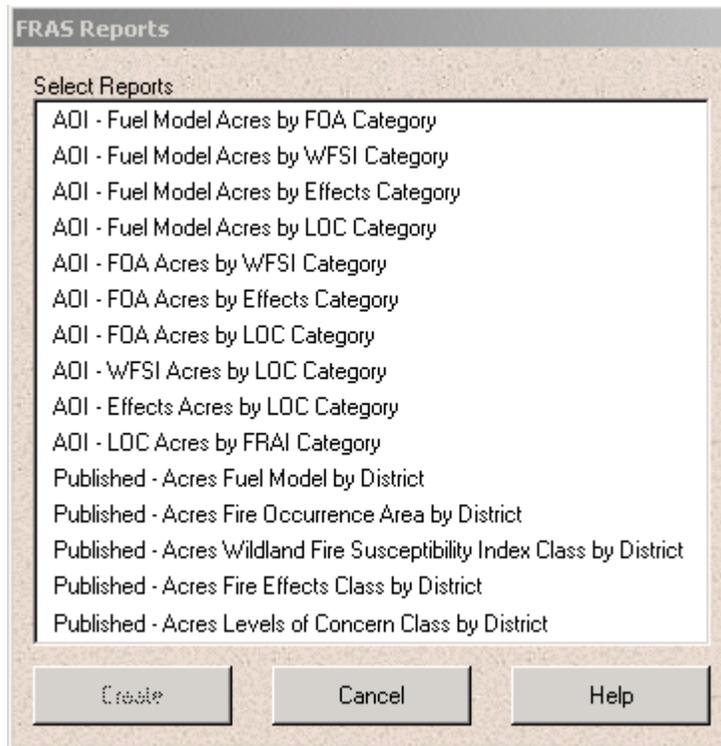
### ***Step 1: Opening the FRAS Reports Dialog***

Select an active AOI Data View and then select the **Create Reports** option from the **FRAS Output** menu.



**Step 2: Selecting a Report to Create**

A reports main dialog will appear. [Figure 94](#) presents this dialog.

**Figure 94: Create Reports – Main Dialog**

There are 14 standard reports provided with FRAS, of which 9 are dynamic reports to reflect the current information within the AOI and 5 are static reports that reflect the Published Results information for the entire state of Florida.

The AOI report titles are preceded by 'AOI -' whereas the Published Results reports are preceded by 'Published -':

*AOI Reports*

- AOI - Fuel Model Acres by FOA category
- AOI - Fuel Model Acres by WFSI category
- AOI - Fuel Model Acres by Effects category
- AOI - Fuel Model Acres by LOC category
- AOI - FOA acres by WFSI category
- AOI - FOA acres by Effects category
- AOI - FOA acres by LOC category
- AOI - WFSI acres by LOC category
- AOI - Effects acres by LOC category
- AOI - LOC acres by FRAI category

*Published Results Reports*

- Published - Acres Fuel Model by District
- Published - Acres Fire Occurrence Area by District
- Published - Acres Wildland Fire Susceptibility Index Class by District
- Published - Acres Fire Effects Class by District
- Published - Acres Levels of Concern Class by District

To create a report using one of these standard formats, select the report title in the list and press the **Create** button.

### ***Error Message if Active View is not an AOI View***

Unlike the maps where any view can be active to generate a map, the reports need to have the AOI view active in order to generate AOI reports. The user will be prompted if an AOI view is not the active view and will not generate the report. This message is presented in [Figure 95](#).

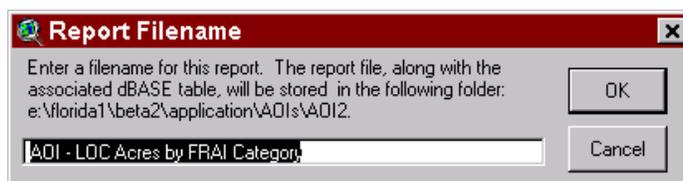
**Figure 95: Create Reports – Active View Error Message**



### ***Defining the Report Filename***

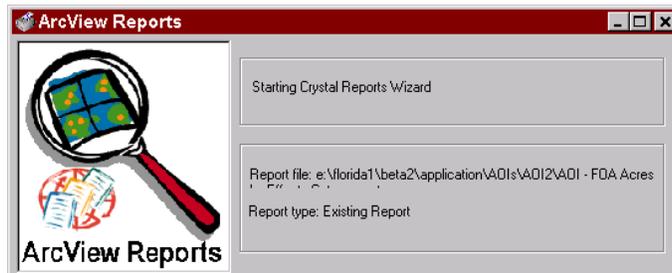
After press the **Create** button in the FRAS Reports dialog, with an active AOI view, FRAS will then query the data layers if the report is an AOI report and prompts the user for an output filename. The file name will be used for the report as well as a dbf file that users can view independently of Crystal Reports. This prompting dialog is shown in [Figure 96](#).

**Figure 96: Create Reports - Report Filename Dialog**



Once the filename has been designated, FRAS generates the report using a predetermined layout in Crystal Reports. A splash screen opens and shows the final filename and location of the file being created as shown in [Figure 97](#).

**Figure 97: Create Reports - Crystal Reports Splash Screen**



***Output Format for an AOI Report***

[Figure 98](#) presents an example layout for the AOI data using Crystal Reports.

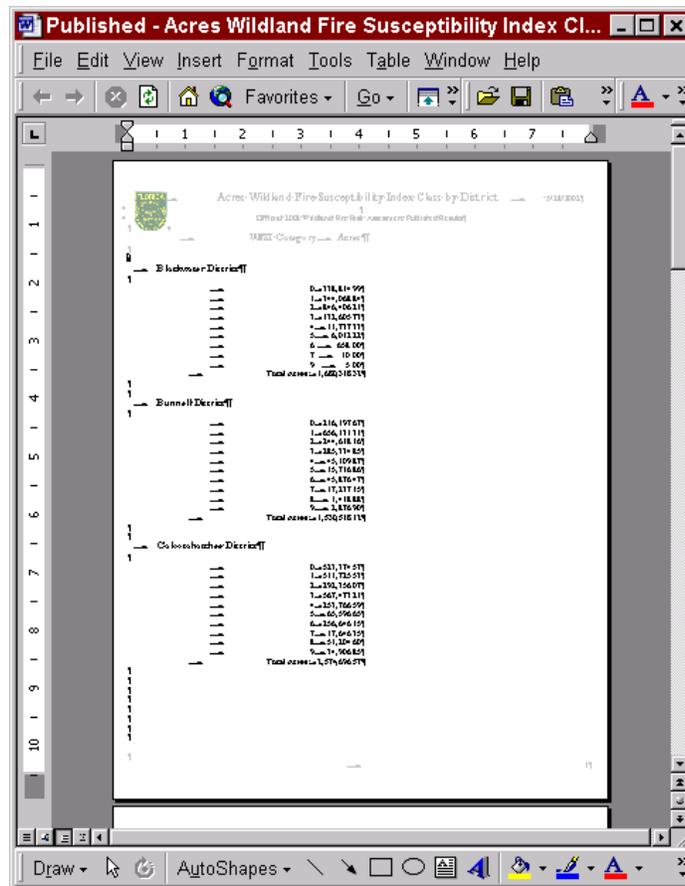
**Figure 98: Create Reports - Example Layout For an AOI Report**

Effects Category	Acres
<b>6.00</b>	
D	2 352.70
D	3 196.15
<b>Total Acres:</b>	<b>548.85</b>
<b>7.00</b>	
D	2 445.67
D	3 171.46
D	4 516.17
<b>Total Acres:</b>	<b>1,133.30</b>
<b>8.00</b>	
D	2 176.58
D	3 237.06
D	4 47.37
<b>Total Acres:</b>	<b>461.01</b>
<b>9.00</b>	
D	1 617.36
D	2 348.64
D	3 422.32
D	4 1,190.24
D	5 420.66
D	6 239.75
<b>Total Acres:</b>	<b>3,237.37</b>
<b>Grand Total:</b>	<b>5,382.59</b>

### Output Format for a Published Data Report

The Published Results reports are static and contain information for all Districts. These reports were generated in Crystal Reports and written to a Microsoft Word document for file transfer. Figure 99 presents an example layout for the published data using Crystal Reports to develop the layout and Word to display the data.

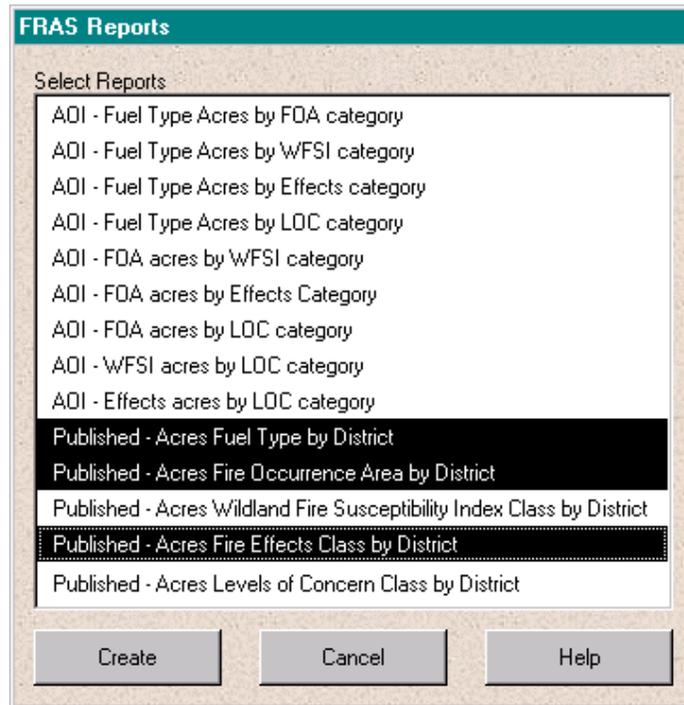
Figure 99: Create Reports - Example Layout For A Published Report



### ***Creating Many Reports at Once***

As with the maps, multiple reports can be selected by selecting the report titles while holding the SHIFT key and then clicking on the **Create** button. [Figure 100](#) presents an example of this.

**Figure 100: Create Reports - Selecting Multiple Reports at Once**



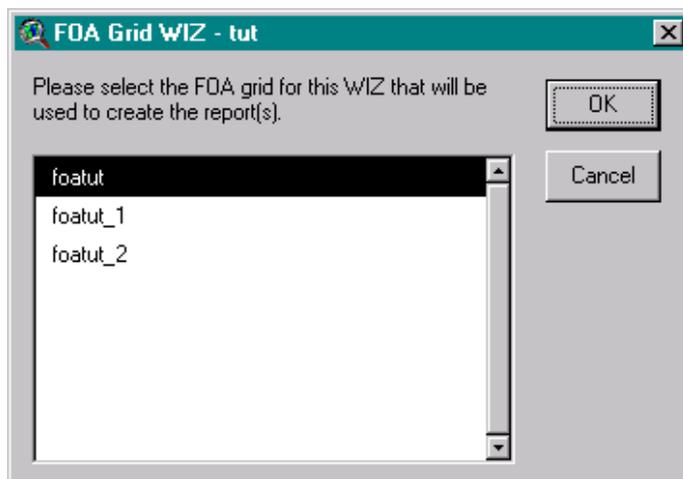
***Creating a Report For Data that has Been Created Using Multiple Runs***

FRAS allows users to create and alter several different data layers including:

- Fuel Models,
- Fire Occurrence Areas,
- Rate of Spread,
- Final Fire Size,
- Wildland Fire Susceptibility Index,
- Environmental Effects,
- Suppression Costs,
- Fire Effects,
- Levels of Concern, and
- Fire Response Accessibility Index.

Accordingly, as discussed in the previous section multiple model run versions of a data set, such as FOA, WFSI, etc., may exist in an active AOI Data View. When this occurs the user will be prompted to select a single version of that layer in order to create the report. [Figure 101](#) presents an example of this dialog.

**Figure 101: Create Reports - Layer Selection Dialog When Multiple Versions of Data Exists**



## Creating Custom Maps and Reports

There are instances when the standard maps and reports cannot be used to portray the information that is needed. In these cases, the user must generate a custom map or report.

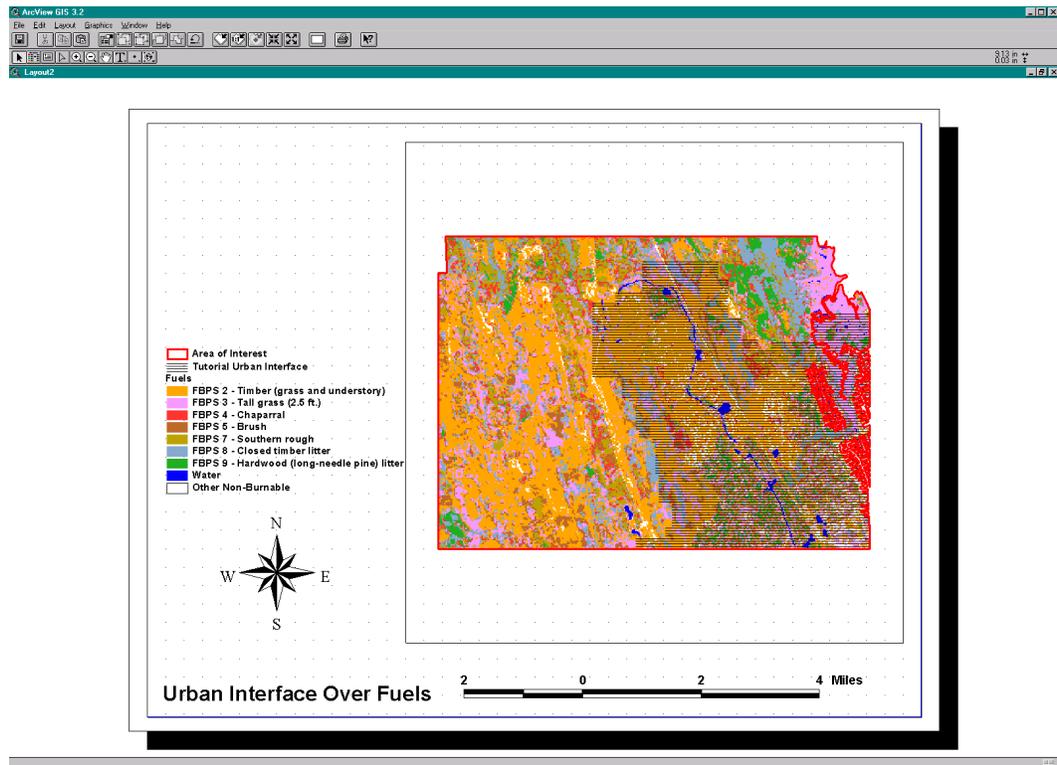
### ***Creating a Custom Map***

A *layout* in ArcView is a map that lets you display views, charts, tables, and graphics. The layout is used to prepare a map for output from ArcView. The standard tools available within ArcView are available to create custom layouts. A review of these capabilities is provided.

To create a new layout, double click on the **Layout** icon in the **Project manager window** (see [Figure 86](#)). A new layout window opens with a blank layout. ArcView provides a few templates that can be used to help organize the layout. FRAS has customized these templates to be easier

and quicker to populate. To use an existing template, choose the **Layout menu** then **Use Template**. The **Template Manager** opens showing a list of available templates. Select the **Landscape** template and click the **OK** button. Notice that the layout now has blank boxes. Double click on the 'View' box and select the correct view that should be used to populate the layout. Once the view is selected, the layout is populated with a scale bar, north arrow, the view, and the legend. The remaining gray box that says 'Empty Text' is for the map title. To add a title, double click on the gray box and add the new text in the text properties dialog box. [Figure 102](#) shows an example of the finished layout.

**Figure 102: Example Layout of a Map Urban Interface Overlaying Fuels**

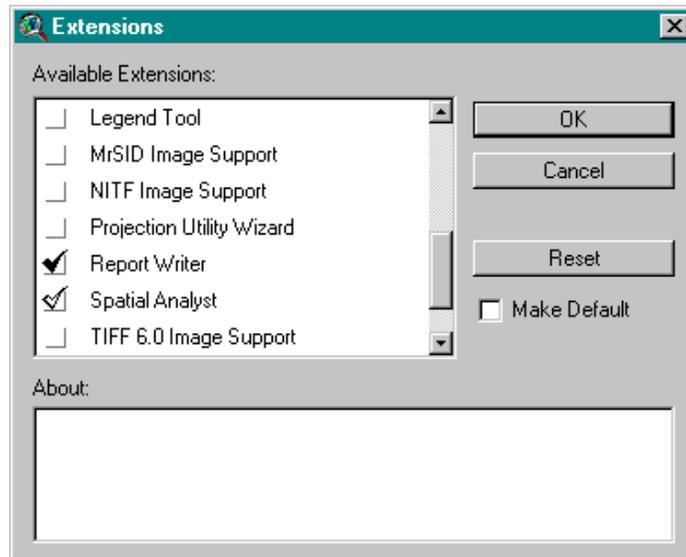


### **Creating a Custom Report**

In order to generate custom reports in ArcView, the **Report Writer** extension must be loaded. To load this extension, click on the **File – Extensions** menu option. [Figure 103](#) presents the Extensions dialog. Scroll down through the list until **Report Writer** appears. If Report

Writer is not listed, ArcView should be reinstalled to install all extensions. Select Report Writer by clicking on the checkbox next to the title. Press the **OK** button to load the extension.

**Figure 103: Extensions Dialog Box**

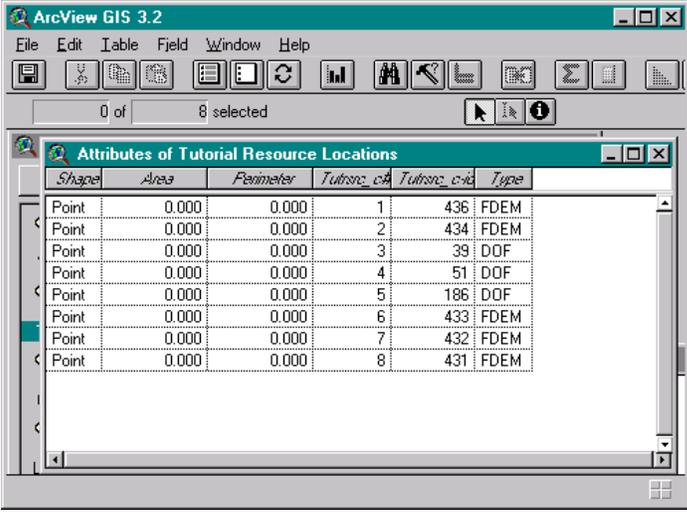


Reports are generated from information in a data table. Accordingly, a data table must be created or opened in ArcView. To generate a simple report of the Resource Locations by type (either DoF, USFS, or FDEM) within a District or AOI, follow these steps:

1. Make the view active – either the AOI Data View or the Published Results View.
2. Activate the Resource Locations theme by clicking on the title until the name is highlighted.

3. Open the resource location table by clicking on the '**Open Theme Table**' button - . [Figure 104](#) shows an example of a table for the Resource Locations for the tutorial data.

**Figure 104: Example Open Data Table**

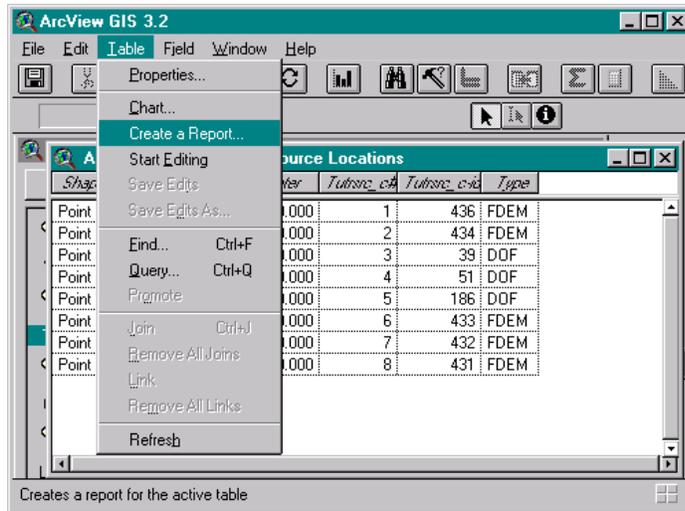


Shape	Area	Perimeter	Tutsrc_id	Tutsrc_cid	Type
Point	0.000	0.000	1	436	FDEM
Point	0.000	0.000	2	434	FDEM
Point	0.000	0.000	3	39	DOF
Point	0.000	0.000	4	51	DOF
Point	0.000	0.000	5	186	DOF
Point	0.000	0.000	6	433	FDEM
Point	0.000	0.000	7	432	FDEM
Point	0.000	0.000	8	431	FDEM

Visual observation of this data set alone shows that there are 3 Resource Locations and 5 FDEM Resource Locations in the tutorial data set.

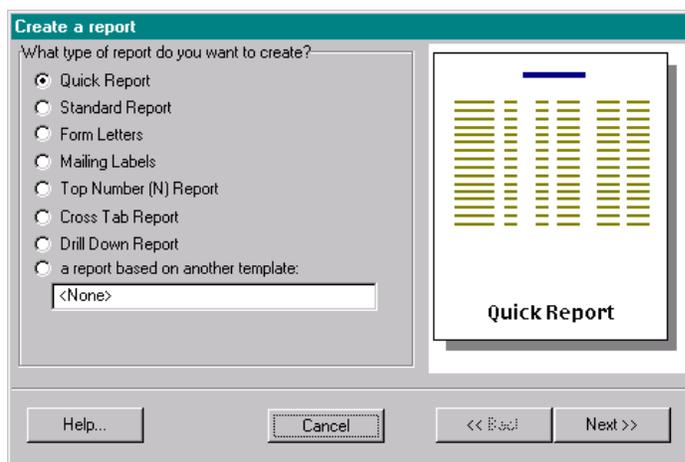
- To generate a report to show the resource by owner (*Type*), select the **Table – Create a Report** menu option. [Figure 105](#) shows this option.

**Figure 105: Table – Create a Report Menu Option**



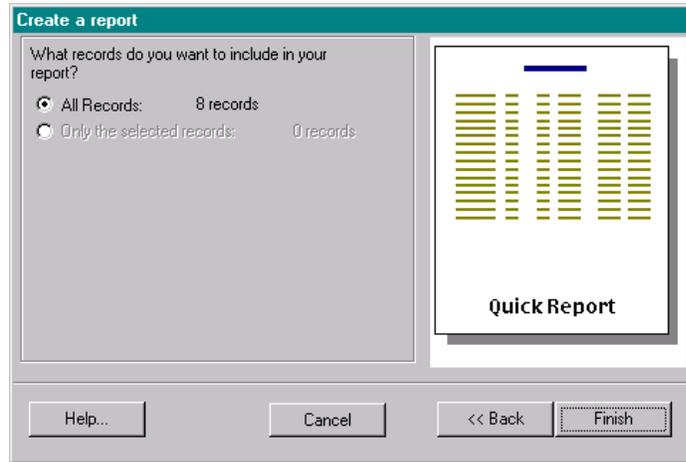
Selecting this option will present the user with the **Create a Report** Dialog as shown in [Figure 106](#).

**Figure 106: Create a Report Dialog**



5. Choose **Quick Report** and press **Next >>**. [Figure 107](#) shows the next dialog.

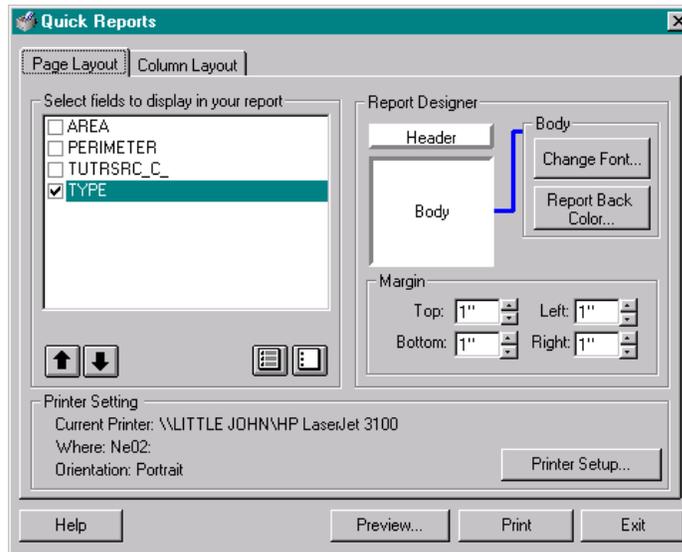
**Figure 107: Second 'Create a report' dialog screen**



6. Check the **All Records** checkbox and press **Finish**. If specific records were previously selected in the table, then the option 'Only the selected records' would also be available. This allows the user to create a report for selected records only.

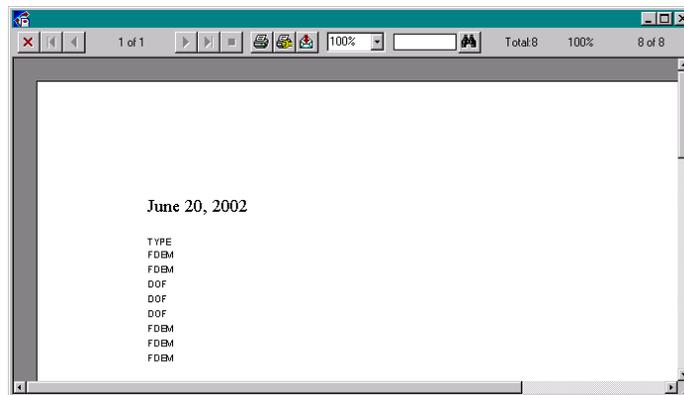
- The Quick Report dialog will appear as shown in [Figure 108](#). Highlight the field **Type** to be displayed in the report and press either **Preview** to preview the report before printing, or **Print** to send the report directly to the printer.

**Figure 108: Quick Reports Dialog**



- If the Preview button is pressed the following report will be appear as shown in [Figure 109](#).

**Figure 109: Example Final Quick Report**

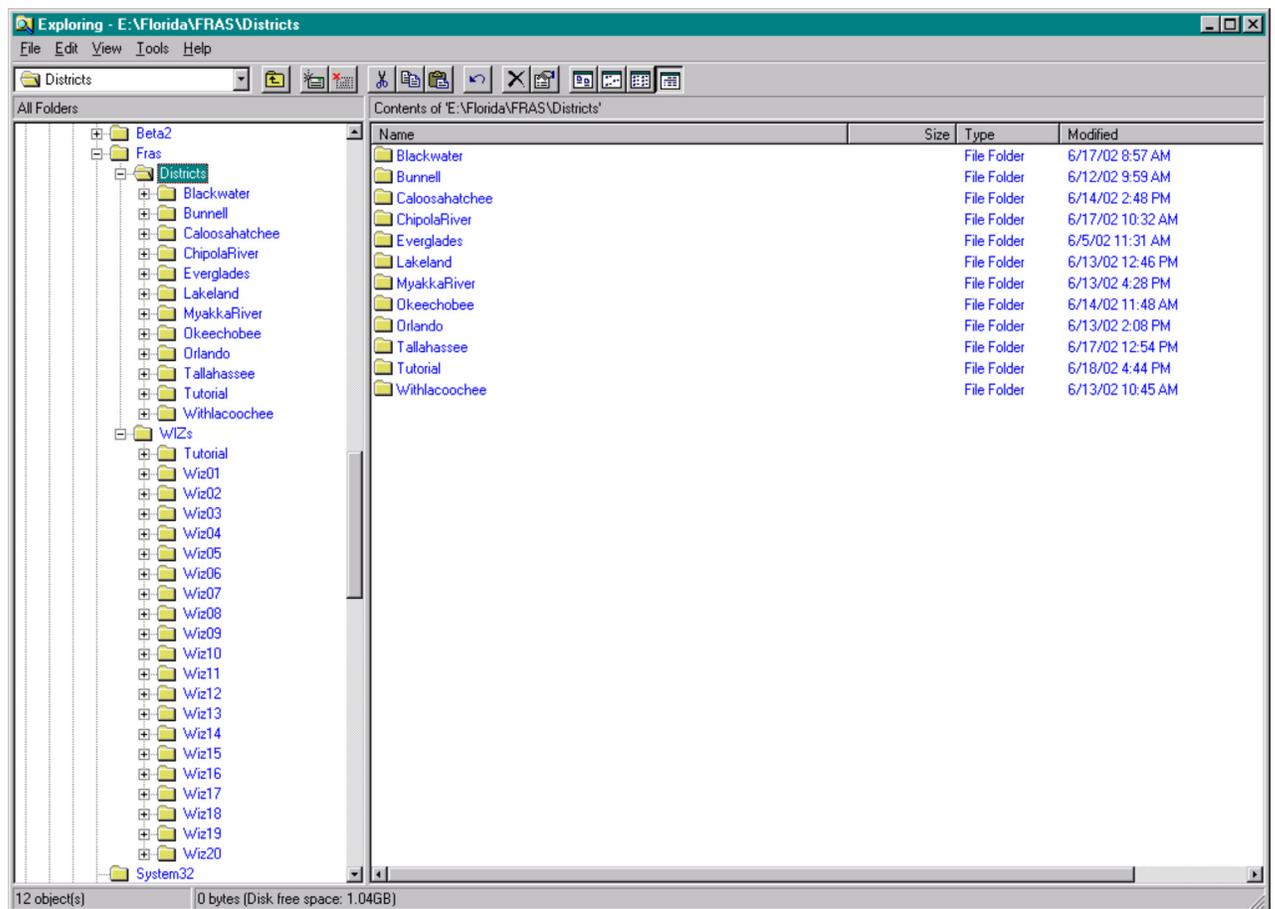


## VIII. Technical Appendices

### FRAS Directory Organization

FRAS consists of data files and application files organized into directories in a predefined manner. This directory structure is established during initial installation of the Published Results District data, and FRAS. For FRAS to operate correctly, the defined data directory structure must be adhered to. [Figure 110](#) presents the subdirectory structure for FRAS.

**Figure 110: The FRAS Directory Structure**



## 1<sup>st</sup> Level FRAS Subdirectories

**Districts** – Is the main directory where District data is stored. Each District must have it's own subdirectory. The naming convention for the DoF District folders is shown below.

Directory Name	DoF District Name
Blackwater	Blackwater
Bunnell	Bunnell
Caloosahatchee	Caloosahatchee
ChipolaRiver	Chipola River
Everglades	Everglades
Jacksonville	Jacksonville
Lakeland	Lakeland
MyakkaRiver	Myakka River
Okeechobee	Okeechobee
Orlando	Orlando
Perry	Perry
Suwannee	Suwannee
Tallahassee	Tallahassee
Tutorial	Tutorial
Waccasassa	Waccasassa
Withlacoochee	Withlacoochee

**WIZs** – Is the main directory where Weather Influence Zone (WIZ) data is stored. Each WIZ must have its own subdirectory. The naming convention for the WIZ directories is:

- Tutorial
- WIZ01
- WIZ02
- WIZ03
- WIZ04
- WIZ05
- WIZ06
- WIZ07
- WIZ08
- WIZ09
- WIZ10
- WIZ11
- WIZ12
- WIZ13
- WIZ14
- WIZ15
- WIZ16
- WIZ17
- WIZ18
- WIZ19

- WIZ20

## Metadata for FRAS Data Layers

Full metadata is provided describing each FRAS data layer in the delivered Metadata folders. Each metadata document contains the following information as described below.

Section in Metadata	Description
<i>Data Set Title</i>	Title of data set used
Geodataset Name:	The name used for data on disk
Geodataset Type:	Arc, ArcView Shapefile, or GRID
Geodataset Feature:	Polygon, Line, Point, Floating or Integer
Description:	Brief description of how the dataset was derived
Source Data Metadata:	Description of source information
• Title:	title used by source to describe data
• Data Source:	source of information
• Geodataset Name:	name used for data on disk
• Scale:	scale at which data was captured at
• Date:	date of information
• Geodataset Extent:	area of extent
Final Data Metadata:	Description of final data layer
• Data Source:	source of final data
• Scale:	final scale

• Data Format:	same as Geodataset Type and Feature
• Date:	Date of compilation
• Geodataset Extent:	area of extent
Feature Attribute Tables:	Description of columns in info tables
Feature Attribute Tables Codes and Values:	Brief description of contents of info tables
User Notes:	Any pertinent information regarding the use of the data set
Map Projection Parameters:	All data layers were projected to the Albers Equal Area Projection
Data Source Contact:	Who to contact if there are any questions regarding the dataset

An example of the metadata is shown below.

**Critical Facilities**

Geodataset Name: CFAC or XXXCFAC where XXX is a three letter abbreviation for District

Geodataset Type: Arc

Geodataset Feature: Polygon

**DESCRIPTION:**

THIS LAYER IS MADE UP OF THE INFORMATION CONTAINED WITHIN THE BURN AUTHORIZATION PLAN. BUFFERS SHALL BE SET AT 1000M FOR AIRPORT AND HELIPOINTS AND 500M FROM ANY OTHER FEATURE CONTAINED IN THE CRITICAL FACILITIES LAYER. THIS LAYER REPRESENTS AREAS THAT ARE SENSITIVE TO SMOKE. US HIGHWAYS AND INTERSTATES WERE ADDED WITH A BUFFER DISTANCE OF 1000M.

**SOURCE DATA METADATA:****Burn Authorization Plan**

- Data source(s): DOF, contact Sue McLellan
- Geodataset Name: XXXCFACP (points)
- Scale: N/A (+- 20')
- Date: 2000
- Geodataset extent: records cover the state of Florida

**USHWY and Interstates**

- Data source(s): DOF, contact Sue McLellan
- Geodataset Name: XXXCFACL (lines)
- Scale:
- Date: 2000
- Geodataset extent: records cover the state of Florida

**FINAL DATA METADATA:**

- Data Source            SIS
- Scale
- Data Format            Polygon Coverage
- Date:                    2001
- Geodataset Extent    State Of Florida

**FEATURE ATTRIBUTE TABLES:**

Datafile Name:    CFAC.PAT

ITEM NAME	WIDTH	TYPE	PRECISION
AREA	12	Number	3
PERIMETER	12	Number	3
CFAC #	5	Binary	
CFAC -ID	5	Binary	
INSIDE	4	Binary	

**FEATURE ATTRIBUTE TABLES CODES AND VALUES:**

Datafile Name:    CFAC.PAT

ITEM	ITEM DESCRIPTION
AREA	Area generated in ArcInfo in square meters
PERIMETER	Perimeter of each polygon in meters
CFAC #	Internal ID number
CFAC -ID	Internal ID number
INSIDE	Whether polygon is within buffer distance, see USER NOTES

**USER NOTES:**

Inside = 100 represents areas within 1000m of an airport or heliport or within 500m of any other facility earmarked as a critical facility according to the Florida Burn Authorization Plan; or within 1000m of a US Highway or Interstate.

**MAP PROJECTION PARAMETERS:**

PROJECTION	ALBERS
Datum	HPGN
Units	Meters
Spheroid	GRS1980
Parameters	
First Standard Parallel	24 00 00
Second Standard Parallel	31 30 00
Central Meridian	-84 00 00
Latitude of Origin	24 00 00
False Easting (meters)	400000
False Northing (meters)	0

**DATA SOURCE CONTACT (S):**

NAME:	SPACE IMAGING SOLUTIONS
Abbr. Name:	SIS
Address:	Space Imaging Solutions 182 South 600 East, Suite 203 Salt Lake City, Utah 84102
Phone:	(801) 325 1006
Fax:	(801) 325 1009
Web Site:	<a href="http://www.spaceimaging.com">www.spaceimaging.com</a>
Contact Person:	Rebecca Megown
Contact E-mail:	rmegown@SpaceImaging.com

## Default Data Symbolization

Standard legends were developed to display information quickly, easily, and precisely for the FRAS user. These legends reflect symbology choices and class thresholds (where appropriate) for all data. These legends are stored as ArcView legend files (.avl).

### *ArcView Legend Files*

All legend files are loaded to the **\$AVHome\FRA** directory during the FRAS installation. The following table describes which legends apply to each of the layers included in the FRAS data. If the data layer is not listed here, that means there has not been a default legend created for that layer.

<b>Data Layer</b>	<b>District or WIZ data</b>	<b>Legend File</b>
<b>BND</b>	District	Dddbnd.avl
<b>CFAC</b>	District	Dddcfac.avl
<b>EnvEff</b>	District	Dddenveff.avl
<b>FAI</b>	District	Dddfai.avl
<b>FCAR</b>	District	Dddfcar.avl
<b>FireEf</b>	District	Dddfireef.avl
<b>FOA</b>	District	Dddfoa.avl
<b>FUEL</b>	District	Dddfuel.avl
<b>H2O</b>	District	Dddh2o.avl
<b>LOC</b>	District	Dddloc.avl
<b>MUCK</b>	District	Dddmuck.avl
<b>PFAI</b>	District	Dddpfai.avl

<b>Data Layer</b>	<b>District or WIZ data</b>	<b>Legend File</b>
<b>PFCAR</b>	District	Dddpfcav.avl
<b>PLNT</b>	District	Dddplnt.avl
<b>PWFSI</b>	District	Dddpwfsi.avl
<b>RDS</b>	District	Dddrds.avl
<b>RDS_C</b>	District	Dddrds_c.avl
<b>RSRC</b>	District	Dddrsrc.avl
<b>RSRC_C</b>	District	Dddrsrc_c.avl
<b>SuppCo</b>	District	Dddsuppco.avl
<b>TOWN</b>	District	Dddtown.avl
<b>URBN</b>	District	Dddurbn.avl
<b>UTIL</b>	District	Dddutil.avl
<b>WFSI</b>	District	Dddwfsi.avl
<b>WizXXX_ext</b>	District	Dddros.avl and dddffs.avl
<b>WizXXX_high</b>	District	Dddros.avl and dddffs.avl
<b>WizXXX_low</b>	District	Dddros.avl and dddffs.avl
<b>WizXXX_mod</b>	District	Dddros.avl and dddffs.avl
<b>Penveff</b>	District	Dddpenveff.avl
<b>PFireEf</b>	District	Dddpfireef.avl
<b>Ploc</b>	District	Dddploc.avl
<b>PSuppCo</b>	District	Dddpsuppco.avl

<b>Data Layer</b>	<b>District or WIZ data</b>	<b>Legend File</b>
<b>FOA</b>	WIZ	Dddfoa.avl
<b>FUEL</b>	WIZ	Dddfuel.avl

### ***Data Classification Thresholds***

FRAS inputs can be categorized as binary, categorical or continuous. Classification thresholds for each layer are shown below.

#### **Binary**

For use in FRAS, the binary layers have one class, therefore no classification thresholds were needed. While one class was used in the FRAS modeling and legends, a number of these layers do have additional attribute information. The FRAS binary layers include; boundary, water, towns, urban interface, utilities, roads and critical facilities.

#### **Categorical**

The classification schemes for the categorical data are as follows:

#### **Fuel Model**

- FBPS 1 – Short grass (1 ft.)
- FBPS 2 - Timber (grass and understory)
- FBPS 3 - Tall grass (2.5 ft.)
- FBPS 4 - Chaparral
- FBPS 5 – Brush
- FBPS 6 – Dormant brush, hardwood slash
- FBPS 7 - Southern rough
- FBPS 8 - Closed timber litter
- FBPS 9 - Hardwood (long-needle pine) litter

- FBPS 10 – Timber (litter and understory)
- FBPS 11 – Light slash
- FBPS 12 – Medium slash
- Water
- Other Non-Burnable

**Muck**

- Muck Class 1
- Muck Class 2

**Plantations**

- FOREST REGENERATION
- MESIC FLATWOODS
- PINE PLANTATIONS
- LONGLEAF PINE
- PINE FLATWOODS
- SAND PINE
- UPLAND CONIFEROUS FOREST

**Fuel Type**

- Other
- Grass
- Shrub
- Timber Litter

### **Continuous**

Class breaks for the continuous data were developed.

### **Fire Response Accessibility Index**

Assuming road travel is 40 miles per hour on the road, 1073 meters can be traveled per minute (1 mile = 1609.3 meters and 60 minutes = 1 hour). The cell size is 30 meters, therefore it takes 0.0279 minutes to travel through 1 cell (30 meters / 1073 meters). To determine how many meters can be traveled within a time frame, for instance < 15 minutes, take (30 meters / 0.0279 minutes) \* 15 minutes = 16129. Therefore the cell value range for this interval will be 0 - 16129.

The following table shows the values used from the FAI grid for each class, as well as the estimated time each class represents.

<b>Meters</b>	<b>Class</b>	<b>Estimated Time (Minutes)</b>
129033 - 200000	1	> 120
64517 - 129032	2	60 - 120
48388 - 64516	3	45 - 60
32259 - 48387	4	30 - 45
16130 - 32258	5	15 - 30
0 - 16129	6	0 - 15

### **Environmental Effects**

<b>Effects Value</b>	<b>Class</b>
0	No Effects
1 - 25	1 - Low
26 - 40	2
41 - 55	3
56 - 100	4 - High

### Suppression Costs

Suppression Costs Value	Class
0 - 14	1 - Low
15 - 53	2
54 - 66	3
67 - 100	4 - High

### Fire Effects

Effects Value	Class
0 - 9	1 - Low
9 - 16.5	2
16.5 - 23	3
23 - 37.8	4
37.8 - 45	5
45 - 100	6 - High

### Rate of Spread

ROS (ch/hr)	Class
0.000001 - 0.9	1 - Low
1.0 - 4.9	2
5.0 - 9.9	3
10 - 14.9	4
15 - 19.9	5
20 - 39.9	6
40 - 79.9	7
80 - 119.9	8
120 - 100000	9 - High
0	Non-Burnable

### Final Fire Size

Acres	Class
0 - 0.24	1 - Low
0.25 - 9.9	2
10.0 - 99	3
100 - 299	4
300 - 999	5
1000 - 4999	6
5000+	7 - High

### Fire Occurrence Areas

To avoid data loss when converting the floating-point grid to an integer, the FOA grid was multiplied by 1000.

FOA Grid Value	Class	Fires/ 1000 Acres / Year *1000
1 - 99	1 - Low	0 - 0.099
100 - 199	2	0.1 - 0.199
200 - 399	3	0.2 - 0.399
400 - 599	4	0.4 - 0.599
600 - 799	5	0.6 - 0.799
800 - 999	6	0.8 - 0.999
1000 - 1999	7	1.0 - 1.999
2000 - 99000	8 - High	2.0 - 99.0

### Wildland Fire Susceptibility Index

To avoid data loss when converting the floating-point grid to an integer, the WFSI grid was multiplied by 100000.

WFSI Grid Value	Class	WFSI * 100000
0	Non-burn	0
1 - 9	Level 1	0.00001 - 0.00009
10 - 99	Level 2	0.0001 - 0.00099
100 - 999	Level 3	0.001 - 0.00999
1000 - 9999	Level 4	0.01 - 0.09999
10000 - 19999	Level 5	0.1 - 0.19999
20000 - 39999	Level 6	0.2 - 0.39999
40000 - 59999	Level 7	0.4 - 0.59999
60000 - 79999	Level 8	0.6 - 0.79999
80000 - 100000	Level 9	0.8 - 1.0

### Levels of Concern

Value	Class
0	Non-burn
0.00001 - 0.00099	Level 1
0.001 - 0.00999	Level 2
0.01 - 0.09999	Level 3
0.1 - 0.23324	Level 4
0.23325 - 0.99999	Level 5
1 - 2.13059	Level 6
2.1306 - 9.99999	Level 7
10 - 19.9999	Level 8
20 - 100	Level 9

## Fuel Treatment Types and the Default Fuel Profile for Years 0 to 10

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
RX Burning												
1	Non-Woody Wetlands - Includes Freshwater Marshes and Wet Prairies	1N	1A	1	1	1	1	1Z	1Z	1Z	1Z	1Z
1	Uplands - Flatwoods and Sandhills, Herb Cover 75-100%	1N	1A	1	1	1	1	1Z	1Z	1Z	1Z	1Z
1	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	1N	1A	1	1	1	5A	5A	5	5	5	5
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Non-Woody Wetlands - Includes Freshwater Marshes and Wet Prairies	2N	2A	2A	2	2	2Z	2Z	2Z	2Z	2Z	2Z
2	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	2N	2A	2A	2	2	2Z	5A	5A	5	5	5
2	Uplands - Flatwoods and Sandhills, Herb Cover 75-100%	2N	2A	2	2	2Z	2Z	2Z	2Z	7A	7A	7
2	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	2N	2A	2	2	2Z	7A	7A	7	7	7	7Z
2	Other	2	2	2	2	2	2	2	2	2	2	2
3	Non-Woody Wetlands - Includes Freshwater Marshes and Wet Prairies	3N	3N	3A	3	3	3Z	3Z	3Z	3Z	3Z	3Z

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
3	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	3N	3N	3A	3	3	3Z	3Z	3	3	3	3A
3	Uplands - Flatwoods and Sandhills, Herb Cover 75-100%, Cogongrass	3N	3A	3	3	3	3Z	3Z	3Z	3Z	3Z	3Z
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Woody Wetlands - Canopy Cover > 60% and Melaleuca	4N	2	2Z	5	5	5Z	4A	4	4	4	4
4	Uplands - Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	4N	4N	4N	4A	4	4	4Z	4Z	4Z	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75%	4N	5	7A	7	7Z	4A	4	4	4Z	4Z	4Z
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Woody Wetlands - Ti Ti Stands/Thickets > 70% of Cover with DBH <= 3 inches	5N	5N	5N	8	5A	5A	5	5	5	5Z	5Z
5	Woody Wetlands - Canopy Cover 25-60% & Shrub Cover > 60%	5N	5N	5N	8	8	8	5A	5A	5	5	5Z
5	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	5N	5N	5N	8	8	8	5A	5A	5A	5	5
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Dead/down material is present and aged and overgrown with live fuel. Slash is from trees, leaves have	6N	8	8	10A	10	5A	5	5	6A	6	6

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
6	Other	6	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	7N	8	8	10A	10	5A	5	5	6A	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% (Gallberry Only)	7N	8	8	10A	10	5A	5	5	6A	6	6	6
7	Other	7	7	7	7	7	7	7	7	7	7	7	7
8	Woody Wetlands - Ti Ti Stands/Thickets > 70% of Cover with DBH = > 3 inches	8N	8A	8A	8	8	8	8	8	8	8	8	8
8	Woody Wetlands - Canopy Cover > 60% & not Melaleuca	8N	8A	8A	8	8	8	8	8	8	8	8	8
8	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	8N	2A	2A	8A	8	8	8	8	8	8Z	8Z	8Z
8	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	8N	2A	2A	2	8A	8	8	8	8	8	8	8
8	Other	8	8	8	8	8	8	8	8	8	8	8	8
9	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	9N	9A	9	9	9	9	9	9	9	9	9	9

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
9	Other	9	9	9	9	9	9	9	9	9	9	9	9
10	Woody Wetlands - Canopy > 60% not Melaleuca, Cypress	10N	2A	2A	2	8A	8	8	8	8	8	8	8
10	Woody Wetlands - Canopy > 60% not Melaleuca, Hardwood	10N	10N	10N	8	8	8	8	8	8	8	8	8
10	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	10N	10N	2A	2A	8A	8	8	8	8	8	8	8
10	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%	10N	2A	2A	9A	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	11N	11N	8	5A	5	5Z	4A	4A	4	4	4	4
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11N	11N	5A	5	7A	7	4A	4A	4	4	4	4
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	11N	2A	2A	2	2	2	2Z	7A	7A	7	7	7
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	11N	2A	2	2	2Z	7A	7A	7	7	7	7	7Z

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
11	Other	11	11	11	11	11	11	11	11	11	11	11	11
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	12N	12N	8	5A	5	5Z	4A	4A	4	4	4	4
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	12N	12N	5A	5	7A	7	4A	4A	4	4	4	4
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	12N	2A	2A	2	2	2	2Z	7A	7A	7	7	7
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	12N	2A	2	2	2Z	7A	7A	7	7	7	7	7Z
12	Other	12	12	12	12	12	12	12	12	12	12	12	12

RX Burning then Chopping

1	Non-Woody Wetlands - Includes Freshwater Marshes and Wet Prairies	1N	1A	1	1	1	1	1Z	1Z	1Z	1Z	1Z	1Z
1	Other	1	1	1	1	1	1	1	1	1	1	1	1
2	Other	2	2	2	2	2	2	2	2	2	2	2	2

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
3	Non-Woody Wetlands - Includes Freshwater Marshes and Wet Prairies	3N	3N	3A	3	3	3Z	3Z	3Z	3Z	3Z	3Z
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Flatwoods, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75%	4N	2A	2	7A	7A	7	7	7Z	4A	4	4
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75%	7N	2A	2	2	2	7A	7A	7	7	7Z	4A
7	Other	7	7	7	7	7	7	7	7	7	7	7
8	Other	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $\geq$ 75%	11N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	11N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A
11	Other	11	11	11	11	11	11	11	11	11	11	11
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	12N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	12N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	12N	2A	2	2Z	2Z	5A	5A	5	5	5Z	4A
12	Other	12	12	12	12	12	12	12	12	12	12	12
RX Burning then Herbicide												
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Other	2	2	2	2	2	2	2	2	2	2	2
3	Uplands - Flatwoods and Sandhills, Herb Cover 75-100%, Cogongrass	3N	1	8A	2A	2A	2A	2	2	2	2	2

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75%	4N	4N	8A	2A	2A	2A	2	2	4A	4A	4A
4	Uplands - Flatwoods, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75% * (Gallberry Only)	4N	5	8A	2A	2A	2A	2	2	5A	5A	5
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75%	5N	5N	5N	2A	2A	2A	2	2	5A	5A	5
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $<$ 75% (Gallberry Only)	7N	2A	1	2A	2A	2A	2	2	5A	5A	5
7	Other	7	7	7	7	7	7	7	7	7	7	7
8	Other	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
11	Other	11	11	11	11	11	11	11	11	11	11	11	11
12	Other	12	12	12	12	12	12	12	12	12	12	12	12
Chopping and Harrowing													
1	Other	1	1	1	1	1	1	1	1	1	1	1	1
2	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	2N	2A	2	2	2	2	2A	2A	8N	8A	8A	
2	Other	2	2	2	2	2	2	2	2	2	2	2	2
3	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	3N	3A	3	3	3	3	3A	3A	8N	8A	8A	
3	Other	3	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	4A	4A	4	4	4	4Z	4Z	4Z	4Z	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75%	11	7A	7	7	7	4A	4	4	4	4Z	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	11	2A	7A	7	7	7	4A	4	4	4	4	4
4	Other	4	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5	5

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
6	Dead/down material is present and aged and overgrown with live fuel. Slash is from trees, leaves have	11A	11A	2	2	5A	5A	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	2	7A	7A	7	7	7Z	4A	4	4	4
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% (Gallberry Only)	8	2	7A	7A	7	7	7	7	7Z	4A	4
7	Other	7	7	7	7	7	7	7	7	7	7	7
8	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	11	11	5A	5A	5	5	5	5Z	4A	4A	4
8	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	11	11	5A	5A	5	5	5	5Z	4A	4A	4
8	Other	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9
10	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	12	12A	5A	5A	5	5	5	5Z	4A	4A	4

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
10	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%	12	12A	5A	5A	5	5	5	5Z	4A	4A	4
10	Other	10	10	10	10	10	10	10	10	10	10	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	2	7A	7A	7	7	7Z	4A	4	4	4
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	11A	2	2	2	7A	7A	7	7	7Z	4A	4
11	Other	11	11	11	11	11	11	11	11	11	11	11
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	12A	2	7A	7A	7	7	7Z	4A	4	4	4
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	12A	2	2	2	7A	7A	7	7	7Z	4A	4
12	Other	12	12	12	12	12	12	12	12	12	12	12
Chopping then RX Burning												
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	2N	2A	2	2	2	2	2	2A	2A	8A	8A

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
	Other	2	2	2	2	2	2	2	2	2	2	2
3	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	3N	3A	3	3	3	3	3	3A	3A	8A	8A
	Other	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	4N	8	5	4A	4	4	4	4Z	4Z	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75%	4N	2A	7A	7	7	7	7	4A	4	4	4
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	4N	2A	7A	7	7	7	4A	4	4	4	4
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Dead/down material is present and aged and overgrown with live fuel. Slash is from trees, leaves have	6N	6N	2A	2	2	5A	5A	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	7N	2	2	7A	7A	7	7	7Z	4A	4	4

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% (Gallberry Only)	7N	2	7A	7A	7	7	7	7	7Z	4A	4
7	Other	7	7	7	7	7	7	7	7	7	7	7
8	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	8	2	5A	5A	5	5	5	5Z	4A	4A	4A
8	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	8	2	5A	5A	5	5	5	5Z	4A	4A	4A
8	Other	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9
10	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	10N	8	2	5A	5A	5	5	5	5Z	4A	4A
10	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%	10N	8	2	5A	5A	5	5	5	5Z	4A	4A
10	Other	10	10	10	10	10	10	10	10	10	10	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11N	2	2	7A	7A	7A	7	7	7Z	4A	4

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	11N	2	2	2	2	7A	7A	7	7	7Z	4A
11	Other	11	11	11	11	11	11	11	11	11	11	11
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	12N	2	2	7A	7A	7A	7	7	7Z	4A	4
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	12N	2	2	2	2	7A	7A	7	7	7Z	4A
12	Other	12	12	12	12	12	12	12	12	12	12	12
Herbicide Only												
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Other	2	2	2	2	2	2	2	2	2	2	2
3	Uplands - Flatwoods and Sandhills, Herb Cover 75-100%, Cogongrass	3Z	3	3A	1	1Z	2A	2A	2	2	2	2
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Woody Wetlands - Canopy Cover > 60% and Melaleuca	4Z	8	8	8	2A	2	2	2	2	2	2

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	4Z	4Z	9Z									
4	Other	4	4	4	4	4	4	4	4	4	4	4	4
5	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	4	4	9Z									
5	Other	5	5	5	5	5	5	5	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% (Gallberry Only)	4Z	4Z	9Z									
7	Other	7	7	7	7	7	7	7	7	7	7	7	7
8	Other	8	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10	10
11	Other	11	11	11	11	11	11	11	11	11	11	11	11
12	Other	12	12	12	12	12	12	12	12	12	12	12	12

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
Mastication												
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	2N	2A	2	2	2	2	2A	2A	8A	8A	8A
2	Other	2	2	2	2	2	2	2	2	2	2	2
3	Woody Wetlands - Canopy Cover 25-60% & Herb Cover > 60%	3N	3A	3	3	3	3	3A	3A	8A	8A	8A
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11	4A	4	4	4	4Z	4Z	4Z	4Z	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75%	4N	2	7	7Z	4A	4	4	4	4	4Z	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	4N	2	7	7	7	7	4A	4	4	4	4
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood	7N	2	7A	7	7	7Z	4A	4	4	4	4Z

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
	Canopy < 75%											
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% (Gallberry Only)	7N	2	7A	7	7	7	7	7	7Z	4A	4
7	Other	7	7	7	7	7	7	7	7	7	7	7
8	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	11	11	5A	5A	5	5	5	5Z	4A	4A	4
8	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	11	11	5A	5A	5	5	5	5Z	4A	4A	4
8	Other	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10
11	Other	11	11	11	11	11	11	11	11	11	11	11
12	Other	12	12	12	12	12	12	12	12	12	12	12
Pile and Burn, Chip, etc.												
1	Other	1	1	1	1	1	1	1	1	1	1	1

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
2	Other	2	2	2	2	2	2	2	2	2	2	2	2
3	Other	3	3	3	3	3	3	3	3	3	3	3	3
4	Other	4	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6	6
7	Other	7	7	7	7	7	7	7	7	7	7	7	7
8	Other	8	8	8	8	8	8	8	8	8	8	8	8
9	Other	9	9	9	9	9	9	9	9	9	9	9	9
10	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $\geq$ 75%	10N	2A	2	2	5A	5	5	5	5	5	5	5
10	Uplands - Flatwoods and Sandhills, Shrub Cover $<$ 60%; Pine Canopy $>$ 60%	10N	2A	2	2	5A	5	5	5	5	5	5	5
10	Other	10	10	10	10	10	10	10	10	10	10	10	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover $\geq$ 60%; Hardwood Canopy $\geq$ 75%	11N	2A	2	2	5A	5	5	5	5	5	5	5

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
11	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11N	2A	2	2	5A	5	5	5	5	5	5
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	11N	2A	2	2	5A	5	5	5	5	5	5
11	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	11N	2A	2	2	2	2	2	5A	5	5	5
11	Other	11	11	11	11	11	11	11	11	11	11	11
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	12N	2A	2	2	5A	5	5	5	5	5	5
12	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	12N	2A	2	2	5A	5	5	5	5	5	5
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Pine Canopy >60%, No Replant	12N	2A	2	2	5A	5	5	5	5	5	5
12	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%, Grass Cover >60%	12N	2A	2	2	2	2	2	5A	5	5	5
12	Other	12	12	12	12	12	12	12	12	12	12	12
Thinning												

Fuel Model	Description	Year										
		0	1	2	3	4	5	6	7	8	9	10
1	Other	1	1	1	1	1	1	1	1	1	1	1
2	Other	2	2	2	2	2	2	2	2	2	2	2
3	Other	3	3	3	3	3	3	3	3	3	3	3
4	Uplands - Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	2	2	7	7	7	4A	4	4	4	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	2	2	7	7	7	4A	4	4	4	4Z
4	Uplands - Flatwoods, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	11A	2	7A	7	7	7	4A	4	4	4	4Z
4	Other	4	4	4	4	4	4	4	4	4	4	4
5	Other	5	5	5	5	5	5	5	5	5	5	5
6	Dead/down material is present and aged and overgrown with live fuel. Slash is from trees, leaves have	11A	11A	2	2	5A	5A	5	5	5	5	5
6	Other	6	6	6	6	6	6	6	6	6	6	6
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75%	11A	2	2	7	7	7	4A	4	4	4	4Z
7	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy < 75% * (Gallberry Only)	11A	2	7A	7	7	7	4A	4	4	4	4Z

Fuel Model	Description	Year											
		0	1	2	3	4	5	6	7	8	9	10	
	Canopy < 75% (Gallberry Only)												
7	Other	7	7	7	7	7	7	7	7	7	7	7	7
8	Uplands - Flatwoods and Sandhills, Shrub Cover >= 60%; Hardwood Canopy >= 75%	8	8	2	2	5A	5	5	5	5	5	5	5
8	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	8	8	2	2	2	5A	5	5	5	5	5	5
8	Other	8	8	8	8	8	8	8	8	8	8	8	8
9	Uplands - Flatwoods and Sandhills, Shrub Cover < 60%; Timber Litter > 60%	9A	9	9	9	9	9	9	9	9	9	9	9
9	Other	9	9	9	9	9	9	9	9	9	9	9	9
10	Other	10	10	10	10	10	10	10	10	10	10	10	10
11	Other	11	11	11	11	11	11	11	11	11	11	11	11
12	Other	12	12	12	12	12	12	12	12	12	12	12	12

## Fuel Model Attributes

Name	1h T/A	10h T/A	100h T/A	Herb T/A	Woody T/A	1h SA/V	Herb SA/V	Woody SA/V	Depth (Feet)	Mx Ex
1 Short grass (1 ft.) - High	0.74	0	0	0	0	3500	0	0	1	12
2 Timber (grass and understory) - FBPS	2	1	0.5	0.5	0	3000	1500	0	1	15
3 Tall grass (2.5 ft.) - FBPS	3.01	0	0	0	0	1500	0	0	2.5	25
4 Chaparral - FBPS	5.01	4.01	2	0	5.01	2000	0	1500	6	20
5 Brush - FBPS	1	0.5	0	0	2	2000	0	1500	2	20
6 Dormant brush, hardwood slash - FBPS	1.5	2.5	2	0	0	1750	0	0	2.5	25
7 Southern rough - FBPS	1.13	1.87	1.5	0	0.37	1750	0	1550	2.5	40
8 Closed timber litter - FBPS	1.5	1	2.5	0	0	2000	0	0	0.2	30
9 Hardwood (long-needle pine) litter - FBPS	2.92	0.41	0.15	0	0	2500	0	0	0.2	25
10 Timber (litter and understory) - FBPS	3.01	2	5.01	0	2	2000	0	1500	1	25
11 Light slash - FBPS	1.5	4.51	5.51	0	0	1500	0	0	1	15
12 Medium slash - FBPS	4.01	14.03	16.53	0	0	1500	0	0	2.3	20
1A Short grass (1 ft.) - Low	0.52	0	0	0	0	3500	0	0	0.7	12
1N Short grass (1 ft.) - Low Spread	0.1	0	0	0	0	3500	0	0	0.12	12
1Z Short grass (1 ft.) - High	0.96	0	0	0	0	3500	0	0	1.3	12
2A Timber (grass and understory) - Low	1.4	0.7	0.35	0.35	0	3000	1500	0	0.7	15
2N Timber (grass and understory) - Low Spread	0.14	0.07	0.04	0.04	0	3000	1500	0	0.07	15
2Z Timber (grass and understory) - High	2.6	1.3	0.65	0.65	0	3000	1500	0	1.3	15
3A Tall grass (2.5 ft.) - Low	2.1	0	0	0	0	1500	0	0	1.75	25
3N Tall grass (2.5 ft.) - Low Spread	0.12	0	0	0	0	1500	0	0	0.1	25
3Z Tall grass (2.5 ft.) - High	3.91	0	0	0	0	1500	0	0	3.25	25
4A Chaparral - Low	3.51	2.81	1.4	0	3.51	2000	0	1500	4.2	20
4N Chaparral - Low Spread	0.15	0.12	0.06	0	0.15	2000	0	1500	0.18	20
4Z Chaparral - High	6.51	5.21	2.6	0	6.51	2000	0	1500	7.8	20
5A Brush - Low	0.7	0.35	0	0	1.4	2000	0	1500	1.4	20
5N Brush - Low Spread	0.09	0.05	0	0	0.18	2000	0	1500	0.18	20
5Z Brush - High	1.3	0.65	0	0	2.6	2000	0	1500	2.6	20
6A Dormant brush, hardwood slash - Low	1.05	1.75	1.4	0	0	1750	0	0	1.75	25
6N Dormant brush, hardwood slash - Low Spread	0.14	0.23	0.18	0	0	1750	0	0	0.23	25
6Z Dormant brush, hardwood slash - High	1.95	3.26	2.6	0	0	1750	0	0	3.25	25
7A Southern rough - Low	0.79	1.31	1.05	0	0.26	1750	0	1550	1.75	40
7N Southern rough - Low Spread	0.1	0.17	0.14	0	0.03	1750	0	1550	0.23	40
7Z Southern rough - High	1.47	2.44	1.95	0	0.48	1750	0	1550	3.25	40
8A Closed timber litter - Low	1.05	0.7	1.75	0	0	2000	0	0	0.14	30
8N Closed timber litter - Low Spread	0.75	0.5	1.25	0	0	2000	0	0	0.1	30
8Z Closed timber litter - High	1.95	1.3	3.26	0	0	2000	0	0	0.26	30
9A Hardwood (long-needle pine) litter - Low	2.04	0.29	0.11	0	0	2500	0	0	0.14	25
9N Hardwood (long-needle pine) litter - Low Spread	0.47	0.07	0.02	0	0	2500	0	0	0.05	25
9Z Hardwood (long-needle pine) litter - High	3.79	0.54	0.2	0	0	2500	0	0	0.26	25
10A Timber (litter and understory) - Low	2.1	1.4	3.51	0	1.4	2000	0	1500	0.7	25
10N Timber (litter and understory) - Low Spread	0.3	0.2	0.5	0	0.2	2000	0	1500	0.1	25
10C Timber (litter and understory) - High	3.91	2.6	6.51	0	2.6	2000	0	1500	1.3	25
11A Light slash - Low	0.85	2.54	3.11	0	0	1500	0	0	0.56	15
11N Light slash - Low Spread	0.29	0.86	1.05	0	0	1500	0	0	0.19	15
11Z Light slash - High	2.22	6.65	8.13	0	0	1500	0	0	1.48	15
12A Medium slash - Low	3.01	10.55	12.43	0	0	1500	0	0	1.73	20
12N Medium slash - Low Spread	0.28	0.98	1.16	0	0	1500	0	0	0.16	20
12Z Medium slash - High	4.64	16.23	19.13	0	0	1500	0	0	2.66	20

## Performance Improvement Tips

FRAS was designed to handle multiple Districts, single Districts, or other user defined areas of interest. Because of the large amount of data required to run FRAS, it is recommended that users recreate layers for small areas of interest (for example, the size of the tutorial) rather than an entire District. Depending upon individual hardware specifications, processing to recreate key layers, such as WFSI, can take, at a minimum, four hours to run FRAS for an entire District.

In order to improve performance it is also recommend that the users have Spatial Analyst installed.

## Definition of Terms

A number of technical terms, acronyms and institutional terms are used throughout this document. To aid the reader in interpreting these, and to minimize the use of footnotes, the following table provides definitions for the terms used in this document.

Term	Description
<b>1-h fuel loading</b>	The one-hour (1-h) timelag dead fuel category includes fuels from 0 to 0.24 inches (0.64 cm) in diameter. This includes needles, leaves, cured herbaceous plants and fine dead stems of plants.
<b>10-h fuel loading</b>	The ten-hour (10-h) timelag dead fuel category includes fuels from 0.25 to 0.99 inch (0.64 to 2.54 cm) in diameter.
<b>100-h fuel loading</b>	The hundred-hour (100-h) timelag fuel category includes fuels from 1 to 2.99 inches (2.54 to 7.62 cm) in diameter.
<b>ArcView 3.x</b>	The conventional standalone ArcView software is ESRI's desktop GIS commercial software. ArcView is proprietary and utilizes the Avenue language for programming applications. ArcView 3.x is the most robust and universally accepted GIS platform in the GIS industry. ArcView is the

Term	Description
	development platform for FRAS.
<b>Area of Interest (AOI)</b>	An AOI is a small area, defined interactively by the user, for which processing will be restricted. In most scenarios, District users may only wish to review, modify or derive new data for a small subset of their District(s). By defining a small AOI, by digitizing on the map, or selecting other data features, they can restrict processing to the small area. Using an AOI greatly enhances modeling performance.
<b>Avenue</b>	The programming language for the ArcView 3.x software platform. Avenue is a scripting language that is embedded within the ArcView 3.x project file format. Using avenue, custom scripts can be bundled with dialog boxes to create a custom application within ArcView. Avenue is a proprietary programming language and is only supported within ESRI's ArcView 3.x software.
<b>District</b>	The key operational administrative area within the Florida DoF for which key FRAS output data has been compiled and derived. Data has been compiled and derived on a per District basis to support operational use of the data.
<b>ESRI</b>	Environmental Systems Research Institute, Inc.
<b>FBPS</b>	Fire Behavior Prediction System Fuel Models
<b>FlamMap</b>	<p>A custom program developed by Dr. Mark Finney (USFS) that calculates a series of fire outputs including Rate of Spread that is required to calculate the Wildland Fire Susceptibility Index (WFSI) data. FlamMap is the core program used with FRAS to determine fire outputs that are used to calculate Levels of Concern outputs.</p> <p>FlamMap is not readily available as released software although it has successfully been applied in fire risk projects by Dr. Finney and other fire management specialists. Accordingly, this version of FRAS uses a revised Beta version provided by Dr. Finney. The first published release is planned for late 2002. FRAS has been integrated with</p>

<b>Term</b>	<b>Description</b>
	FlamMap to support future use of the new FlamMap version when it is available.
<b>FMD</b>	FlamMap custom fuel file suffix
<b>FMS</b>	FlamMap fuel moisture file suffix
<b>FOA</b>	Fire Occurrence Areas
<b>FRAI or FAI</b>	Fire Response Accessibility Index
<b>FRAS</b>	Fire Risk Assessment System
<b>GRIDASCII (ASCIIGRID)</b>	The ESRI ASCII exchange format for their raster format GRID data. GRIDASCII format is used to facilitate the conversion of data to and from FRAS and the external FlamMap fire behavior program. This conversion is seamless and the user is not required to know about the GRIDASCII format or data files.
<b>LCP</b>	FlamMap landscape file suffix
<b>Live herbaceous fuel loading</b>	Live herbaceous fuels are grasses and forbs that are living. Herbaceous fuels can be either annual or perennial.
<b>Live woody fuel loading</b>	Live woody fuels are shrubs that are living.
<b>LOC</b>	Levels of Concern
<b>Pull-down Menu</b>	Refers to a textual list of menu items that 'pull-down' from the top main menu in an application. Selecting a menu item will result in a list of options. FRAS is available within ArcView as a series of pull-down menu options. Selecting an option with prompt the user with a dialog (form) to run the selected function.
<b>Rate of Spread (ROS)</b>	Fire rate of spread is a primary output derived by the FlamMap fire behavior program. ROS is used as a key input for deriving the WFSI within FRAS. By changing modeling

<b>Term</b>	<b>Description</b>
	inputs in FRAS, such as fuel models, the ROS needs to be recalculated using FlamMap. The FlamMap ROS data is then used by FRAS to derive WFSI and ultimately the Levels of Concern (LOC) outputs.
<b>Rds</b>	Roads data layer abbreviation
<b>Rsrc</b>	Resource Locations data layer abbreviation
<b>Spatial Analyst</b>	Spatial Analyst is a module for the ArcView GIS that facilitates raster data modeling and analysis. Most of the modeling processes within FRAS utilize the Spatial Analyst module to create output data, including WFSI, LOC, and FRAI. LOC output can also be created without using Spatial Analyst.
<b>Spread Component (SC)</b>	An estimate of the spread rate of a fire burning with the assumptions of weather, fuels and topography.
<b>WFSI</b>	Wildland Fire Susceptibility Index
<b>WIZ</b>	Weather Influence Zone

## **Project Participants**

The FRAS project team is comprised of staff from State of Florida Division of Forestry, Space Imaging (the contractor) and independent consultants. This team includes fire behavior and planning specialists, as well as remote sensing and GIS specialists. In addition to the project team, a number of additional fire management experts were involved in numerous workshops undertaken throughout the project. Primary team members include:

### ***State of Florida Division of Forestry***

- James Brenner, Fire Management Administrator (Project Manager)
- Sarah Esner, Assistant Project Coordinator

- Sue McLellan, GIS Analyst
- Scott Goodrick , State Meteorologist

***Space Imaging Staff***

- Julie Coen, Manager, Utah Operations (Project Manager)
- David Buckley, Director, GIS Solutions
- Mark Brennan, Director, Remote Sensing Solutions
- Rebecca Megown, GIS / Remote Sensing Analyst / Programmer
- Wendy Goetz, Remote Sensing / GIS Analyst
- David Grey, Remote Sensing / GIS Analyst
- Ken Bunzel, GIS Analyst / Programmer

***Project Consultants***

- Donald Carlton, Fire Program Solutions – Fire Protection Planning Specialist
- Butch Neal, PBS&J – Fuels and Fire Behavior Specialist
- Geoff Babb, The Nature Conservancy – Fuels and Fire Behavior Specialist

A full list of staff involved in the project is provided in the following section, [Project Team Members](#).

**Project Team Members**

This section provides a detailed list of project team members who provided critical information during FRAS workshops, the Field Data collection and draft map review.

**Workshop Members – Effects Rankings**

A two-day workshop was held to assign risk scores and rankings to Environmental Effects and suppression costs to produce the published fire effects results. These scores are being used as defaults to derive Levels of Concern in FRAS. The following DOF staff were involved in assigning the final scores and rankings:

John Kern, Ralph Crawford, Tim Elder, James Brenner, Mike Long, Ray Geiger, Mark Hebb, Jim Karels, Mike Kuypers, Ed Flowers, Bruce Hill, Brian McKee, Joe Anderson

**Workshop Members – Fuel Profiles**

A two-day workshop was held to develop fuel profiles (years 0 through 10) following different fuel treatments to develop the **FRAS Fuels Modification Tool**. We would like to recognize the following DoF staff for their participation at the Workshop.

Mark Clere, Keith Mousel, John Kern, Tim Elder, Fred Adrian, Duane Weise, Dave Fogler, George Custerer, James Brenner

**Field Data Collection**

The DOF District staff spent countless hours in the field collecting the field data and reviewing draft maps. We would like to acknowledge those that collected data for each District.

**Blackwater** – Ed Ferguson, Wes Jones, Allen Qualls

**Bunnell**- Ray Durham, Will Raulerson, Phillip Yoeman, Rick Davis, Brad Lane, Leonard King, Gary Carpenter, Rabun Jarriel, Jim Hostetter, Donnie Trice, Stephen Lloyd, Charles Cassels

**Caloosahatchee** – Mark Ferguson, Nate Jenkins, Marc Rogers, Roy, Mike Sawyer

**Chipola River** – Brian Archer, Roger Avriett, Tom Beitzel, Joey Brady, Frank Brogdon, Dan Childs (Tindall Air Force Base Forester), Geoff Cummings, Rochelle Ferrera, Annie Jones, Kristi Kaple, Gery McIntyre, LeaAnna Melton, Chester Rushing, David Stull, Steve Tullar, Shane Wells,

Cory Wilson, Roger Yarbrough, Daniel Young, Richard Gilmore (Consulting Forester assist)

**Everglades** – Alex de la Paz, Papayorgis, Skip Russell, Sean Sinclair, Robert Trincado, Chris Wasil, Malcolm Francis

**Jacksonville** – Annaleasa Winter, Johnnie Addison, Steve Gaul, Larry Stombock, Henry Hobbs, J.L. Anderson, Tim Keener, Brad Mizeras, Thelton Goff, Beth Smith, Stanley Brown, Bob Ray, Bill Chandler, Jerry Clevenger, Jody Farley, Tim Stiltner

**Lakeland** – Pat Dwyer, Dennis Herndon, Terry Jones, Pat Keogh, John Knowles, Ned Waters, Robin Whitaker, Windeaters

**Myakka River** – Ed Flowers, Duane Weis, Ed Ferguson (Blackwater), Doug Robicheaux (Blackwater), Jeremy Keller, Steve Wilson

**Okeechobee** – Brighton, Hammock, Randy Gregory (Tallahassee), Travis Bentley (Tallahassee), Robert Trincado (Everglades), Vincent Hill (Tallahassee), Chris Wasic (Everglades), Frank Gibbs (SFR), Mike Lightsey (SFR), Dale Armstrong, Charlie Collier, Giovanni Cueto, Tim Elder, Ken Fucci, Mike Good, Tim Hawks, Shannon Hyattt, Tim Rain, Mike Sawyer, Jim Swingle, Keith Yeates

**Orlando** – Brad Blackman, Dan Bogenrief, Joe Burroughs, Charlie, Kase Coggins, Mike Coker, Tom Donohoe, John Koehler, Dana Sussmann, Travis Bentley (Tallahassee), Ron Weis

**Perry** – Robin Marquette, Shane Wells, Carlor Gutierrez, Howard Holland, Jimmy LaValle, John Fish, Rufus McMullen, Ralph Crawford

**Suwannee** – Lee Barnwell, Jon Handrick, Stan Shepard, Bryan Thrasher, Jay Tucker, Neal White, Tim Wilkinson

**Tallahassee** – Herbert Franklin, Travis Bentley, Vincent Hill, Phil Czechorowski, Randy Gregory, Milton Shuler, Shane Wells

**Waccasassa** – Ralph Crawford, Sarah Culhane, Jarc, Jeffrey Watson, Shane Locke, Rufus McMullen, Meadows, Matt Johnson

**Withlacoochee** – Terry Claflin, Pat Dwyer (Lakeland District), David Fogler, Dennis Herndon (Lakeland District), Michael Josey, John Kern,

Alan Kirby, Shane Locke (Waccasassa), Ray Lovett, Tonya Miller, Gary Schreiber, Jason Thompson, Derik Vogt, Vince Morris, Colleen Werner